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FACULTY OF THE BUILT ENVIRONMENT

DEPARTMENT OF CONSTRUCTION ECONOMICS AND MANAGEMENT

Evaluating the Adaptability of Green Buildings in the Sustainability Agenda in South Africa

BY

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ABSTRACT

In South Africa, there is a growing awareness of green buildings because they are understood to be environmental sustainability. Yet at the same time building adaptability has the ability to provide sustainability to building structures because it enables ease of response to building user changes. The thrust of this study was to evaluate how much adaptability is incorporated in the design and construction of green buildings in order to minimize unnecessary building obsolescence and prevent the premature demolition of the structures. This is because demolition of buildings is wasteful and unsustainable, hence the importance of constructing adaptable green buildings. Building adaptability helps to preserve and prolong the lifespan of buildings thereby contributing to their long-term sustainability.

A mixed method of a questionnaire and semi-structured interviews was used to investigate the phenomenon and to collect data from a sample of engineers, architects and sustainability consultants who are involved in the accreditation of green buildings. The study was limited to commercial office buildings that have a green star rating.

The research indicated that, in general, most green buildings in South Africa are not designed and constructed with adaptability in mind. However, in the commercial office space, most of the buildings are constructed with some level of flexibility due to the fast nature of the business environment that requires that the interior building spaces be adaptable to change of use by different tenants. Findings from the research also indicated that, even though the current rating tools for green buildings used in South Africa do acknowledge some elements of building adaptability, the rating tools are generally silent on building adaptability as a whole. Consequently, efforts by engineers and architects to design adaptable green buildings are not fully recognised and rewarded for. The lack of incentive for designers to design adaptable buildings is one of the reasons why the concept of building adaptability has not been fully embraced as a design principle in the construction of green buildings in South Africa.

DECLARATION

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LIST OF ABBREVIATIOONS

GBCSA	Green Building Council of South Africa
CPD	Continual Professional Development
SACAP	South African Council of the Architectural Profession
ECSA	Engineering Council of South Africa

CHAPTER 1: INTRODUCTION

1.1 CHAPTER OVERVIEW

This chapter introduces the background of the study as well as giving a brief overview of the major themes in literature that will be discussed in detail in the next chapter. It is in this chapter where the problem statement is discussed together with the objectives of what the research study seeks to achieve when the research questions have been answered. An outline of all the chapters is provided as a road map at the end of the chapter.

1.2 INTRODUCTION

The demands of building users are ever-changing, which makes it a requirement that buildings should undergo modifications structurally in response to that change, (Geraedts, 2006). Because accommodation needs within communities change over time, there is a need to have adaptive spaces that are not only responsive to these changes but that also have the ability to even allow for different users to enjoy the spaces at different times, (Etteh, 2016). To maintain real life cycle value of buildings, it is important that buildings are maintained to remain efficient dwellings to work and live in (Gibb *et al.*, 2007). Gorgolewski (2005) suggests that values, activities and morals of people constantly change with time, hence buildings as dwellings that accommodate people, are expected to be flexible in copying with these changes as they happen.

Lans and Hofland (2005) differentiates changes in user requirements according to human behaviour into intern and extern changes. Intern changes are specific to one household whilst extern changes concern the activities of several individual households influencing society. In general intern cyclic and non-cyclic changes can be predictable, studied, investigated and inferred whilst extern changes are due to societal influences and are not as predictable.

The capacity of building structures to respond to user needs changes during the lifetime of the structure is determined in the early stages of development through design decisions made, (Schmidt III *et al.*, 2010). Gorgolewski (2005) is of the opinion that designers, when designing buildings, must recognise the effect of time on buildings and the likelihood of buildings undergoing several changes during their lifetime. What people experience when inhabiting buildings is the end results of design decisions and choices that were made in the past. In essence architectural work done today is all about designing the future. Gorgolewski (2005) goes further to compare buildings to a chameleon in that in the same way a chameleon changes its colour to adjust to its surroundings, similarly buildings must be designed to evolve over time and be able to adapt to user requirement changes.

1.3 BACKGROUND TO THE STUDY

The concept of building adaptability in the built environment is a relatively old phenomenon. According to (Pinder *et al.*, 2011) as far back as 1960s the knowledge of the need for adaptive building was already there. The recent years however has seen a growing interest from academics and built environment professionals on the subject of adaptability (Pinder *et al.*, 2013) due to a number of reasons, which include advancement in technology and the desire to preserve building stock and prevent premature obsolescence.

1.3.1 Defining Building Adaptability

Literature around building adaptability has various definitions of what it constitutes. Schmidt III *et al.* (2010) suggests that almost all definitions imply the ability to accommodate some kind of change in the use of the building. This is because the usefulness of a property is often compromised by its inability to be accommodative to changes. The environment inside and outside a building often tends to change much quicker than the structure itself. A building that is static and rigid is unable to respond adequately to such dynamics of society.

Nakib (2010) defines building adaptability as the in-built ability of a building structure to be able respond to changes by adapting and adjusting to different uses, thereby permitting different spatial and functional configurations, without causing significant disturbance to the building, the operation of activities as well as the environment. This means that adaptable buildings should be able to provide room to later rearrange internal spaces to satisfy various needs, uses and lifestyles in several scenarios (Nakib, 2010). Often the adaptation of existing buildings occurs during its lifecycle and in many cases the changes made differ vastly from the original design intent that was envisaged (Pinder *et al.*, 2013).

In the built environment most structures are built at a point in time, specifically with a single use in mind, without factoring the future into the picture (Eguchi *et al.*, 2010). Adaptable buildings, however, are designed and constructed with long-term use in mind, and for that to be feasible it requires a strong knowledge of present and future user needs to ensure the building adapts well to the inevitable demand changes that will occur in time (Pani, 2014). The essential value of building adaptability is that it not only recognises but also acknowledges the difficulty of predicting future building user needs and hence does not seek to design for permanent rigid single use structures but to rather design for adaptability and material recovery in future (Ross *et al.*, 2016). Gibb *et al.* (2007: p1) summaries the adaptability concept by saying “the future is uncertain- the present must be adaptable”.

1.3.2 Design for Adaptability

Graham (2005) defines the concept of design for adaptability as a strategy implemented at the design stage of building development with a sole purpose of preventing premature obsolescence of a building, mainly by incorporating flexibility components on the design that ensures that during the building lifecycle, the structure not only adjust but also adapt to changing user requirements as well as the environment. Essentially, design for adaptability is a design framework that is aimed at maximising the time a building structure and its components continue to be in productive use. Kestner and Webster (2010) suggest that design for adaptability has the potential of prolonging the life of a building structure by its mere attribute of adapting readily to user demand changes. However, for buildings to be adaptive to evolving user needs it is paramount that the design allows not only for reconfiguration during productive life, but should be able to permit reuse, alteration as well as recycling of redundant elements (Schmidt III *et al.*, 2011). However, in most built environment project designs, the principle of adaptability is rarely considered or fully embodied. In many instances, adaptability elements are introduced in a haphazard, unplanned and untimely manner (Schmidt III *et al.*, 2010). According to Davison *et al.* (2006) very few existing buildings presently have been intentionally designed for adaptability, which makes it difficult to evaluate the effectiveness of adaptability over time.

Graham (2005) suggests that the basic underpinning principle behind the concept of design for adaptability is the idea of forsaking the perception of seeing a building as a static fixture in a landscape but to rather viewing it as a system of constructed layers having varying lifespans that can be managed and maintained at different times as the need presents. The fundamental principle behind the design

for adaptability strategy is the following: designing structures with the end in mind, to plan for change by allowing provisions on the design, to view the longevity of a building by designing for long life, designing for loose fit by incorporating flexibility elements on the design and lastly, designing for deconstruction to allow ease of disassembling and recycling (Graham, 2005).

A demountable structure is one way of realising flexibility in a building because it permits ease of detaching old building components and replacing with new ones (Van Herwijnen, 2000). Design for adaptability is most beneficial to buildings that are highly likely to undergo functional changes over their lifespan such as commercial retail malls, industrial buildings, office buildings, particularly where the spaces are rented out to different tenants, and any other building that is frequently used or rented out to various users (Kestner and Webster, 2010).

1.3.3 Flexibility

The word flexibility is broad and has varied meanings depending on the context used (Gijsbers and Lichtenberg, 2014). With regards to building flexibility, there are two distinct types; namely process flexibility and product flexibility. Process flexibility relates mostly to the design stage of building development. It refers to flexibility in decision making in the development process from the design of the project through to its construction and building operations (Geraedts, 2006). Gijsbers and Lichtenberg (2014) defines process flexibility as the ability and freedom of choice in making design changes throughout the development process. Product flexibility on the other hand relates to the user stage. It is concerned with the ease at which it is to alter the composition and components of a building in order to adapt to changing user demand requirements (Van Herwijnen, 2000). Gijsbers and Lichtenberg (2014) refers to it as the flexibility in use and defines it as the ability of a building structure, during its use, to undergo functional and spatial alterations that are tailored to the changing needs of the users.

Flexibility in buildings allows for functional changes to be made quicker with minimum effort or cost (Leaman *et al.*, 1998). This is because flexibility provides built-in techniques that make it possible to rearrange components, remove or add on elements and systems conveniently when the need arises (Arge, 2005), which in turn makes renovations and conversions quicker and financially viable (Gijsbers and Lichtenberg, 2014). There is a direct relationship between adaptability and flexibility because each feeds the other, hence a flexible building is an adaptable building and vice versa. Gijsbers and Lichtenberg (2012) explains the distinction between the two terms in that flexibility concerns itself about designing a building for more than one function use while the focus of adaptability concerns the means in which flexible use is technically achieved. Adaptability framework aims at addressing unknown uncertainties in the future through embedding various design flexibility options that can be triggered when the need arises in the future (Allahaim *et al.*, 2010).

Within the built environment in South Africa, there is consensus of the need for adaptable buildings to meet future unknown user requirements, to enable buildings to last forever (Ham and Wouters, 2006). However, most buildings presently are not technically unequipped to respond to the ever-changing needs of users (Gijsbers and Lichtenberg, 2012). Because of various regulations and traditions in the built environment, the common tendency is to design single use buildings that are rigid (Unzurrunzaga and Branchi, 2013). As such building structures are constructed as monoliths with all the components firmly joined together, making the structure inflexible to change.

1.3.4 Sustainability Agenda

There is a growing recognition in the built environment that sustainable real estate is one way of withstanding the effects of economic crisis, that has resulted in increased enthusiasm on sustainable developments (Remøy *et al.*, 2011). Sustainability in buildings refers to buildings that are able to meet current user needs without compromising the fulfilment of future users of the same property (Kisnarini *et al.*, 2015). Collins *et al.* (2010) elaborates further on the concept of sustainability by asserting that for anything to be considered truly sustainable it must be able to maintain its state of sustainability presently as well as for its entire lifecycle. For that to be possible it must have adaptive abilities so that it remains relevant throughout changing circumstances. Sustainable buildings are identified by their inherent ability to adjust to changing environment and circumstances but without expending too much environmental waste (Manewa *et al.*, 2016). In that sense sustainable buildings can be viewed as adaptable buildings. Geraedts (2016) finds a direct connection between adaptable developments and sustainability in that the longer a building structure stays functionally productive the lower the vacancy rate and therefore the more sustainable the building. Hence, building adaptability can be used as a means of promoting sustainability, to help in the preservation of embodied energy by prevention of unnecessary demolitions. However, it is important to note that for a building to be sustainable it does not necessarily have to last forever but rather it must be easily adaptive to change (Graham, 2005). Buildings that are adaptable to user demand changes are sustainable and enable property decisions to begin to effectively reflect a sustainable investment as property investors gain confidence to take property as a long term investment (Bullen and Love, 2011a).

The impact of a building on the environment is twofold; on the operational level and embodied energy component. Operational environmental impact involves energy consumption when the building is in use, whereas embodied environmental impact comes into play during the actual construction of the building (Kestner and Webster, 2010). Pollution produced during construction is an example of embodied impacts. The building construction plays a pivotal role in the sustainability agenda because the deliverance of construction work inevitably impacts on the environment, consumes a lot of resources that cannot be recovered and creates large amounts of waste. Adaptable buildings are inherently sustainable because during construction the consumption of materials is less, and there is relatively less pollution (Wilkinson *et al.*, 2009). The challenge of the construction industry is to create economical building structures that enhance the quality of life without impacting negatively on society, economy and environment (Zabihi and Habib, 2012). Close to half the emissions of greenhouse gas is contributed to the activities in the built environment and as such building adaptation is encouraged worldwide by many local authorities by promoting green buildings by reducing greenhouse gas emissions and excessive energy consumption related to building works in urban areas (Wilkinson and Remoy, 2011). Hence Manewa *et al.* (2016) acknowledges that adaptable buildings are intrinsic to a sustainable environment, and this view is widely recognised in the built environment.

1.3.5 Green Buildings and Sustainable Development

According to United Nations World Commission on Environmental and Development sustainable development is development that not only meets the needs of the present generation but has an ability of meeting the needs of the generations to come in the future (Wedding and Crawford-Brown, 2007). Essentially, built environment sustainability is considered to be “a holistic approach to the adaptation of environmental, economic and socio-cultural concerns in the design and built evolution of architecture” (GhaffarianHoseini *et al.*, 2013: p4). Omer (2008) asserts that buildings account for

approximately 40% of energy consumption entirely in the world. This shows the significance of the sustainability to be embraced within the built environment.

The demand for sustainable buildings over the years has resulted in a growing interest in green buildings. Olubunmi *et al.* (2016) defines green buildings as a practice of constructing building structures that are environmentally sustainable by incorporating responsible processes that are also resource efficient throughout the life of a building from design up to operation.

Green buildings as a term is often synonymous to sustainability, and consequently sustainability in the built environment is often understood from the perspective of green buildings (Falkenbach *et al.*, 2010). As a result, the use of the word 'green buildings' is used interchangeably with sustainable buildings (Dwaikat and Ali, 2016). Environmental sustainability is significantly impacted by the activities in the construction industry. The construction and demolition of buildings pollutes the environment through the dust and noise produced, traffic congestion, water contamination and pollution, as well as the manner in which waste is disposed (Zuo and Zhao, 2014). The agenda of green building is advanced by a sustainable construction criteria practised by architects and developers from design stage through to construction and up operation of a facility (GhaffarianHoseini *et al.*, 2013).

1.3.6 Obsolescence and Adaptability Re-use

Obsolescence is a word that is derived from a Latin word 'obsolecsere', a word that means to grow old (Butt *et al.*, 2015). It is regarded as a situation whereby the building's utility has declined. It is important to note that the utility decline occurs regardless of use, passage of time or environmental elements (Grover and Grover, 2015).

With regards to existing building stock, obsolescence is a cause for concern (Manewa *et al.*, 2016) and adaptive reuse as a strategy to minimise negative impacts of building obsolescence is promoted (Kincaid, 2000). Adaptive reuse has been defined by Bullen (2007) as a conversion of an existing building structure in order adapt to change of use required by its building users. Adaptive reuse is not only a cheaper option but also preserves the style and heritage of old buildings (Ball, 1999). Reuse of existing building stock has been recognised as a positive contribution to the sustainability agenda in the built environment (Bullen, 2007) because existing building stock is an economic, social and cultural asset worthy to be preserved and not be wasted by demolition (Myers and Wyatt, 2004), thereby promoting the agenda of green buildings and environmental sustainability. Conejos *et al.* (2011) suggests that alternatively, building adaptive reuse can be used in place of traditional demolition and reconstruction of old building stock as it is a conservative choice that entails less energy and waste. In industrialised countries there is a growing call to limit or completely stop the construction of new buildings in favour of adapting existing ones (Bullen, 2007). Since continual improvement is one of the important goals of sustainability, it is befitting that improvement of existing building stock by adaptation is perceived as an efficient sustainability strategy (Bullen, 2007).

Because demolition is a wasteful and environmentally unsustainable practice, adaptive reuse offers a better alternative option of effectively dealing with obsolescence in existing structures because it has been found to produces less waste whilst consuming less materials (Bullen and Love, 2011b) due to the fact that the building is not completely demolished to be reconstructed, as in the case of demolition. It is suggested by Bullen and Love (2011a) that buildings that can provide multiple use through adaptive reuse have are more appealing and command a high demand to property users and investors because of their flexibility to be put to different uses with less hustles and inconveniences. However, despite the justification for adaptive reuse, the current reality is that buildings are still designed and constructed for obsolescence and with relative short-term single use (Bullen, 2007).

1.3.7 Stakeholder Perspectives and Influence.

Various stakeholders involved in the construction of a building have the power to influence the adoption of building adaptability and hence understanding their perspective is important. A stakeholder can be defined as a person or group of people who have a direct influence and a vested interest in the outcome of a project (Olander, 2007). Whilst in some cases there can be stakeholders who have more influence than others, it is possible in other cases to have stakeholders who stand to benefit or lose more than others from the success of a project. Pinder *et al.* (2013) categorises stakeholders into four groups; Champions, Gatekeepers, Outsiders and Bystanders. Accordingly, champions are stakeholders who have a great influence on the project and also stands to benefit from its success. An example of this group is the client who initiates the building project. Gatekeepers are stakeholders who have a great influence on the success or failure of the project but derive fewer personal benefits or loss out of its success of failure. Typically, this group is made up of professional project team members such as the Architects, Engineers, Quantity Surveyors. Outsiders are people or organisations that have a vested interest on the project and also stand more to benefit from its success but have less influence, such as end users, facility managers and society at large. Bystanders are organisations that not only derive fewer benefits but also have less influence, such as local authority personnel.

Aapaoja and Haapasalo (2014) categorises stakeholders differently, although still into four groups according to the level of impact they have on the project. The first group of key players is composed of people who have a direct responsibility to the success of the project such as the professional team and the contractor. The second group is stakeholders that must be kept regularly informed of ongoing developments on the project and mainly is composed of local residents and communities including non-governmental organisations. The third group is stakeholders are those that must be kept satisfied all the times. Often this group has requirements that must be met and have the power to stop the project at any time if those requirements are not met, although they do not have personal interest on the project, such as provincial and national government, and local municipality authorities. The fourth group is referred to as minimum effort on the project and are not regarded as salient and focal. In this research the use of the word stakeholder shall have reference to former meaning given by Pinder *et al.* (2013).

Within the built environment there is a belief that the notion of constructing adaptable building is costly and comes with increased construction costs (Pinder *et al.*, 2011). It is common for engineers to over specify items such as floor loadings, services such as electrical and mechanical works in an effort to cater for unknown future functional user changes. Such future proofing inevitably results in unintended consequences of increased construction costs, that would eventually be passed on to occupiers and tenants in the form higher rents and service charges. According to Kurul (2007) most developers and clients base more of their investment decisions concerning building adaptability on perception rather than on analysis of costs, value or risk. Thus, the major challenge building designers face is convincing clients to spent more on future proofing a building. Although that is a difficult task, what however, makes it easy is the knowledge that what ultimately motivates building clients and developers is profit or future financial savings and so clients would be willing to spend more if they believe that there would be future benefits in the form of profits or savings (Pinder *et al.*, 2013).

Arge (2005) asserts that there is strength in identifying and understanding which stakeholder stands to benefit most from building adaptability because that forms the driving force. As such, commercial developers who develop properties for sale have no clear motivation to construct adaptable buildings unless such buildings would command higher premiums in the market and are easy to sell off quicker than other buildings because of the reason that occupiers or investors perceive them as appealing and

attractive for one reason or another. The reason for that behaviour is two folded. Firstly, the benefits of adaptive buildings are reaped in the future by the eventual building users and secondly, the cost of adaptation is also borne in future by building users. Because commercial developers have a relative short-term interest on buildings, they have no incentive to develop adaptive buildings unless they can be sold at a higher price and there is a demand for them. However, for owner-occupiers and developers with a long-term building interest such as institutional investors and those that develop buildings for rental and management, they are motivated towards adaptive buildings because the increase in initial construction costs is justified by lower future adaptation and maintenance costs together with improved rentals. Ellison *et al.* (2007) suggests that adaptive buildings have high flexibility and require infrequent and less costly refits. Hence rentals tend to be relatively higher in such buildings.

Geraedts *et al.* (2014) asserts that there are three different perspectives to demand change needs of buildings. The perspectives vary depending on whether they are from users, owners or society. The societal perspective places much importance to the preservation of use value of buildings and also emphasises that a building must remain attractive for generations of various users in order to guarantee a long-life cycle. The building owners' perspectives is hinged on the long-term profitability whilst from a users' perspective what is most important is that the core business being delivered remains fit for the building offered.

Inevitably this results in a circle of blame as suggested by Pinder *et al.* (2011) whereby developers are not developing adaptive buildings because they believe investors are not attracted to them and hence will not fund them, while on the other end investors are reluctant to fund adaptive buildings because they believe that there is insufficient demand and market for them, and yet building end users want the convenience of flexible dwellings but find that there is only few available. On the far end there is building designers and contractors frustrated that they are willing to design and construct adaptive buildings but are inhibited by developers who are not asking for them. Consequently, blame circle perpetuates endlessly until it is broken.

1.4 IMPORTANCE OF THE STUDY

Currently in South Africa the phenomenon of green buildings and building adaptability is often viewed in isolation, as two abstract principles that do not serve each other. Yet literature shows that building adaptability has the ability to preserve and prolong the lifespan of buildings, thereby minimising unnecessary premature demolitions and thus contributing to the environmental sustainability of buildings. It the endeavour of this research study to investigate the link between building adaptability and green buildings and how building adaptability can enhance the sustainability of green buildings.

1.5 PROBLEM STATEMENT

Sustainability in the built environment is important. Building adaptability is one way of ensuring long term sustainability and environmental preservation because of the reduced need for demolition of structures and rebuilding them, thereby promoting green buildings. However, it is important to interrogate the adaptability of green buildings. This is because constructing buildings that are environmentally sustainable according to green building precepts but that are however, not adaptable defeats the purpose because of the risk of obsolescence in the long run if the buildings cannot adapt to the inevitable changing user requirements and demands. Despite such buildings being environmentally sustainable, their inability to adapt may eventually lead to demolition, thereby contributing to environmental degradation.

1.6 RESEARCH QUESTIONS

The research question for this research is:

> What level of building adaptability is incorporated into the design and construction of green buildings in South Africa?

1.7 RESEARCH PROPOSITION

The research proposition for this research is:

> Building adaptability is not yet entrenched as one of the criteria of rating green buildings in South Africa.

1.8 RESEARCH OBJECTIVES

The objectives of this research are to:

1. Investigate the connection between building adaptability and green buildings.

2. Explore the extent to which professionals in the built environment of South Africa incorporate building adaptability strategies in the design and construction of green buildings.

3. Assess how building adaptability contributes to the criteria of rating green buildings.

4. Identify ways of raising awareness of building adaptability in order that it is adopted in the design and construction of green buildings.

1.9 RESEARCH METHOD

The following processes are followed in gathering information on the subject:

- In-depth literature review and analysis in order to understand the prevailing concepts already established in the academic world so as to get a critical review of relevant literature;
- First-hand information from semi-structured interviews of professionals in the built environment of South Africa;
- Questionnaires will also be used to collect data.

The mixed research method approach is deemed most suitable because it would be able to obtain appropriate data and information necessary to understand the phenomenon.

1.10 RESEARCH SCOPE AND DELIMITATIONS

Yin (2006) states that establishing the limitations of a study is important on every research undertaken. The following are the research limitations for this study:

1. The study is limited to professionals in the built environment of South Africa.

2. The professionals considered in the study are Architects, Engineers, Sustainability Consultants affiliated with GBCSA.

3. Because of time constraints, all the interviews conducted were in Gauteng although some of the projects discussed were across the country.

4. For the questionnaire survey, challenges were experienced getting access to all the professionals affiliated with GBCSA who have experience working on green building. Consequently, the survey was sent to the target professionals regardless of affiliation.

5. The rating tool under consideration on this study was the GBCSA Green Star.

6. Green buildings studied were limited to commercial office buildings.

1.11 CHAPTER LAYOUT

The following is the structure and chapter lay out of the research:

Chapter one lays out the introduction of the research, bringing out the problem statement and objectives that are driving the study. Research questions to be answered by the research are presented on this chapter.

Chapter 2 delves deep into literature review around the topic. It reviews in detail existing literature that has been written around the subject, bringing out the major themes to address the problem.

Chapter 3 covers Research Methodology. It identifies and justifies the methodologies used to assess the phenomenon. Discussed also on this chapter is the population and sample type and size, together with the methods to be used to collect data.

Chapter 4 includes data presentation where the data collected is presented in various forms, and then analysed and discussed.

Chapter 5 provides the conclusion drawn from the preceding data analysis and discussion. Recommendations for further future studies is given also on this chapter.

CHAPTER 2: LITERATURE REVIEW

2.0 CHAPTER OVERVIEW

As sustainability is at the crux of green buildings and adaptability, this chapter begins by defining sustainability together with its tenets, before discussing the sustainability of green buildings. The

concept of adaptability in buildings is discussed in detail, bringing out what drives it as well as the barriers that hinder the implementation of it. Environmental assessment tools as a means of measuring the greenness of buildings are discussed and interrogated in terms of their adequacy to measure adaptability of green buildings. The chapter closes by looking at interaction of various stakeholders in the built environment and their conflicting interests in the development of a project.

2.1 SUSTAINABLE BUILDING IN THE BUILT ENVIRONMENT

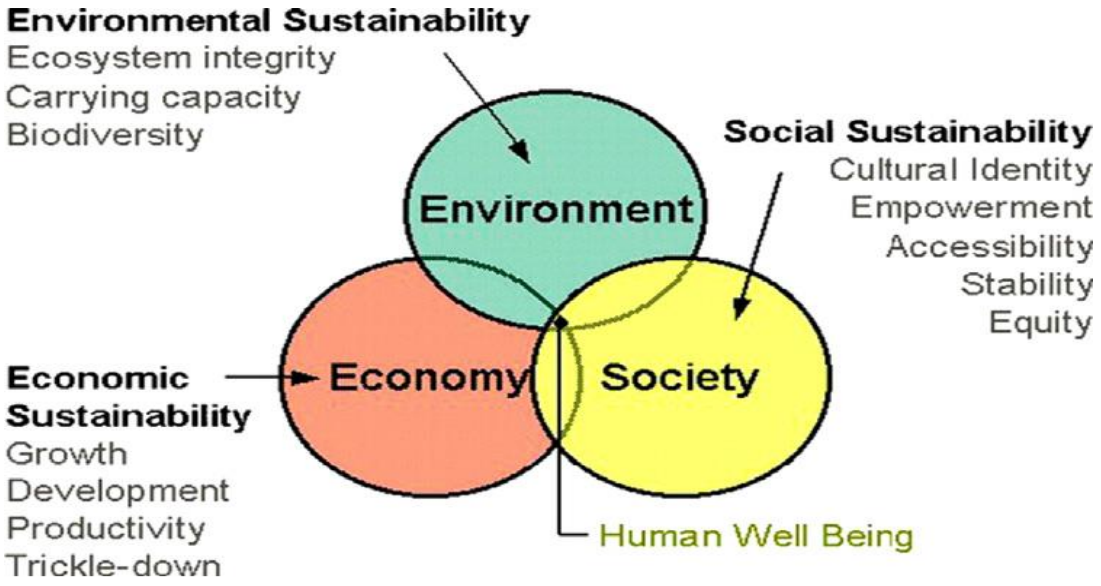
Akande and Minami (2017) defines sustainability in buildings as the development and protection of a building in such a way that the facility meets the needs of its present users together with the needs of the future generations that will occupy the building. "One of the most important aspects of sustainable development goals in constructed environment is adaptability with social, economical, and environmental conditions and one of its important characteristics is efficient planning, facilitation of adaptation and changeability, and design for change, reducing costs, protection and improving natural and environmental values" (Zabihi and Habib, 2012: p 576).

A sustainable building is not necessarily a building that can last forever, but rather one that is able to adapt and respond easily to change (Graham, 2005). According to Kendall and Ando (2005) a sustainable building is one with an inherent ability to respond to changing circumstances without producing too much waste and conflict. A building that is designed and constructed in a manner that does not embrace the notion of change and reuse can only provide an illusion of sustainability because flexibility and adaptability are essential if sustainability in buildings is to be achieved (Estaji, 2017).

Long-term utility value is a critical precondition for sustainability and the capacity of an adaptive building to accommodate different uses throughout its lifespan constitutes utility value (Geraedts *et al.*, 2014). Hence, Collins *et al.* (2010) asserts that a sustainable building can also be described as an adaptable building. Marciniak (2015) is of the opinion that sustainability of a building is not only about energy efficiency but is also concerned about possibilities of adaptability for alternative use. The concern of the impact of buildings on the environment is what has underpinned and driven the fascination and interest towards building adaptability (Graham, 2005). However, many built environment clients are not currently concerned about adaptability although they are aware of green issue responsibilities (Eguchi *et al.*, 2010). Tentative signs which indicate there is a move in the direction of a more sustainable development are seen by the gradual appreciation of the value of disused structures by the private sector (Lützkendorf and Lorenz, 2005). This is because there is a realisation that a sustainable real estate is more resilient to economic downturns (Remøy *et al.*, 2011).

The tenets of sustainable development are economic, environmental and social sustainability (Zabihi and Habib, 2012; Manewa *et al.*, 2016; Vyas and Jha, 2018), and a sustainable building should have a balance of these three sustainability aspects. Manewa *et al.* (2016) elaborates further by explaining that economic sustainability is concerned with how a building can provide better value for its property owners, environmental sustainability is about how environmental benefits can be optimised by a building, and social sustainability focuses effects of a building on the wellbeing of society. However, because most of the times green buildings are synonymous with sustainability of buildings, understanding of sustainability in buildings is often limited and perceived from the environmental sustainability point of view alone, with neglect to the economic and social sustainability aspects (Falkenbach *et al.*, 2010). Figure 2.1 below depicts the three pillars of sustainable development.

Fig 2.1: Tenets of sustainable development



Source: (GhaffarianHoseini *et al.*, 2013: p4)

Building construction expends a lot of unrecoverable resources, produces large amounts of waste and is responsible for the creation of half of the total carbon dioxide (Zabihi and Habib, 2012). Some of the environmental negative effects of building construction experienced during the construction period include noise, water pollution, traffic congestion, dust and disposal of waste (Zuo and Zhao, 2014). Even the disposal of buildings, when they reach the end of their lifecycle, involves a lot of energy consumption and waste (Zuo and Zhao, 2014).

The necessity to reduce consumption of natural resources, gas emissions and energy use in the built environment is the source for the quest for sustainability of buildings, which in turn, has triggered interest in adaptable buildings (Bullen, 2007). Moffatt and Russell (2001) argue that adaptable buildings are relatively less taxing on the environment for two major reasons. Firstly, they create less embodied and replacement energy, and secondly, the production of waste material is reduced.

One way of defining sustainable construction is that it is the application of the concept of sustainable development, and yet another way is to view it as the response and responsibility of the construction industry towards the sustainability issues and sustainable development (Hoffman and Henn, 2008; Tan *et al.*, 2011; Kibwami and Tutesigensi, 2016). Whilst traditional construction is concerned with cost, performance and quality of buildings, sustainable construction is about how building constructions consume resources and impact on the environment (Sev, 2009). The role played by the construction industry in attaining sustainable development come with a dilemma (Bonacci, 2003). While on one hand construction is essential to fulfil the needs of growing populations and urbanisation, on the other hand the same construction activities consume energy and natural resources and harm the environment (Wu *et al.*, 2016). For instance, the production of raw materials such as cement and steel produces at least five percent of global man-made carbon dioxide emissions (Worrell *et al.*, 2001). Transporting raw materials to construction sites is also energy intensive (Peng and Sui Pheng, 2011). Furthermore, during the actual construction work, unnecessary carbon emissions may be produced (Wu *et al.*, 2013). The production, transportation and installation of raw materials such as concrete, steel and glass requires large amounts of energy (Bribián *et al.*, 2011). The building industry is one of the biggest sources of gas emission and is increasingly receiving pressure to minimise greenhouse gas emissions (Wu *et al.*, 2014). This is why it is important, when evaluating the

sustainability of building projects, to consider embodied carbon emissions (Kibwami and Tutesigensi, 2016) because reducing gas emissions from buildings, as suggested by Lin and Liu (2015) is one of the most effective and significant ways of eliminating negative effects on climate change. In comparison with other industries, the construction industry presents a uniquely unusual case because its products have a long lifespan and therefore impose a long lasting impact on the environment (Sev, 2009). Thus, efforts to address concerns of the impact of the buildings on the environment has given rise to the rapid growth and acknowledgment of the concept of green buildings (Wang *et al.*, 2016).

2.2 ENERGY CONSUMPTION EFFICIENCY OF BUILDINGS

It is common knowledge, according to Nelms *et al.* (2007), that the construction and operation of traditional buildings use up significant resources and creates large amounts of solid waste. The built environment around the world, has a significant contribution to global greenhouse gas emissions, where up to 45% of carbon dioxide gas emissions can be directly or indirectly attributed to the construction and operation of buildings (Sbci, 2009). Different phases of a building lifecycle produce large quantities of carbon dioxide to the sky through the processes of manufacturing building materials and subsequent installation of them into the construction work, even up to demolition at the end of the lifecycle (Zuo and Zhao, 2014; Vyas and Jha, 2018).

Globally, greenhouse gas emissions from buildings account for 40% of all greenhouse gas emissions (W.B.C.S.D, 2007; Omer, 2008; Yudelson, 2008; Gunnell *et al.*, 2009; Son *et al.*, 2011). Greenhouse gas emissions are the major driving force behind global warming and climate change (Pérez-Lombard *et al.*, 2008; Zuo and Zhao, 2014; Geng *et al.*, 2017). It is for this reason that sustainable development is promoted globally as a means of reducing gas emissions and global warming (Chan *et al.*, 2017) because there is a wide recognition that lowering greenhouse gas emissions from buildings is one of the most effective and important ways to reduce global warming (Lin and Liu, 2015). If no effort is made to improve energy consumption efficiency of buildings, the International Energy Agency predicts that by the year 2050 there will be a 50% increase in the energy consumption of the building sector. Construction and operation of buildings in South Africa contribute up to 23% of the greenhouse gas emission, and the manufacturing of major building materials produces approximately 4% of total carbon dioxide gas emissions (Gunnell *et al.*, 2009).

Source of energy consumption and gas emissions can be broadly categorised into two groups: namely operational energy and embodied energy (Kestner and Webster, 2010). Accordingly, operational energy is the energy that is emitted by a building during its operation through the function of lighting, heating, air conditioning etc, whilst embodied energy is the energy given out during the process of manufacturing building raw materials and well as during the installation of those raw materials into the construction work. Most of the times efforts to reduce greenhouse gas emissions from buildings tend to focus only on operational energy during building use (Iwaro and Mwasha, 2010). Wang *et al.* (2014) advises that although energy consumption during the building operation stage is essential, it is important to consider energy consumption from a holistic standpoint that encompasses the total lifecycle of buildings.

Wang *et al.* (2016) goes further in detailing the sources of gas emissions and energy consumption from buildings. Accordingly, there are four sources and the first source is embodied emissions from construction processes, and includes extraction and manufacturing of raw materials, transporting them to site and the actual installation. The second source is the operation emissions transmitted from the operation of the building such as use of air-conditioning units, water heating, lighting, cooking, use of computers, etc. The third source is the maintenance emissions from building maintenance work and includes the extraction and manufacture of raw materials, transportation to

site and the actual maintenance work installation. The last source is the demolition emissions from the process of demolishing buildings at the end of their lifespan. Hence, Wang *et al.* (2016) stresses the importance of measuring greenhouse gas emission from a whole lifecycle perspective and avoid assessing green buildings from one perspective of greenhouse gas emissions from building operations. GhaffarianHoseini *et al.* (2013) suggest that energy consumption and gas emissions from buildings require innovative solutions in order to achieve sustainability in the built environment. Table 2.1 below shows different sources of emissions during the life cycle of a building.

Table 2.1: Building life cycle emission sources

Emission sources	Scopes and boundaries
Embodied emissions	
Production and transportation of materials and equipment	Raw materials extraction, manufacturing, transportation
Construction process	Construction and installation, worker's office and commuting
Operation emissions	
Building emissions from resource consumption	Operation of building-incorporated services e.g. air-conditioning, lighting, water heating, elevator
Occupant emissions from resource consumption	Operation of other appliances and equipment e.g. computer, printer, projector, cooking, entertainment
Direct GHG emissions from equipment	e.g. Freon from refrigeration fluid
Maintenance emissions	
Production and transportation of materials and equipment	Raw materials extraction, manufacturing, transportation
Maintenance process	Maintenance and installation, worker's office and commuting
Demolition emissions	
Demolition process	Demolition, transportation, worker's office and commuting

Source: (Wang *et al.*, 2016: p486)

Kurul (2007) argues that adaptive reuse has a potential of adding value to sustainability and climatic change by lowering emissions of carbon dioxide. One of the reasons adaptive reuse is environmentally sustainable is because the process results in a reduction in embodied energy, because there is less demolitions involved in the construction (Bullen and Love, 2011a). This is supported by Binder (2003) and Schultmann and Sunke (2007) who assert that new buildings have a relatively high embodied energy compared to adaptively reused ones. Significant embodied energy savings can also be derived from reuse of building materials that otherwise would have been wasted (Reddy and Jagadish, 2003). Adaptive reuse is a process that harvests the gains of embodied energy as well as the quality of the initial building, in a sustainable manner (Bullen and Love, 2011b). According to (Ross *et al.*, 2016) adaptability does not only promote sustainability but also contribute in the preservation of embodied energy, carbon dioxide, and materials from the old building already invested due to the fact that demolition is reduced. Hence the relevance of building adaptability and reuse in terms of commercial and sustainability viewpoint is increasingly growing in recognition (Davison *et al.*, 2006).

2.3 GREEN BUILDINGS AND SUSTAINABILITY

The term 'green building' in literature is used interchangeably with words such as sustainable building, high performance building, sustainable construction or green construction (Kats *et al.*, 2003; Zuo and Zhao, 2014; Darko and Chan, 2016). Dwaikat and Ali (2016) view green buildings as healthy facilities that inflict fewer negative effects on the environment. Green buildings are a new phenomenon that, in recent years, have shifted from obscurity to light (Windapo, 2014). A study conducted by Windapo (2014) revealed that green building in South Africa is at an infancy stage, with little enthusiasm from both the government and the public. Rogerson (2014) also concurs this by elaborating that commercial green developments in South Africa are a new and recent phenomenon. The study by Windapo (2014)

further revealed that rising energy costs and the desire to reduce operation costs of buildings are the key drivers of green buildings in South Africa.

According to Ali and Al Nsairat (2009), green buildings presents an opportunity to construct buildings that are environmentally efficient because of the integrated design approach used to minimise the negative impact of the buildings to the environment and to building occupants. Green buildings fall under the umbrella of sustainable development (Vyas and Jha, 2018) and Yoon and Lee (2003) argue that essentially, green buildings in this century, have become a flagship for sustainable development.

According to Conejos *et al.* (2011) the most green buildings with the highest 'green' credentials are those buildings that already exist, which have been upgraded to improve their greenhouse gas emission. This is because although the constructing new buildings that are green is ideal, it consumes more resources in the form of land, building materials and uses up a lot more energy, compared to adapting existing buildings that are in good physical condition and making them green (Conejos *et al.*, 2011). As land becomes scarce, continual demand for the construction of new buildings with improved efficiency is environmentally unsustainable because it means existing building may have to be demolished to make room for new buildings invariably (Langston, 2008). There is increasing calls, especially in industrial countries, to reduce new constructions, or even stop them completely, in favour of adapting already existing buildings (Bullen, 2007). Moreover, Tobias and Vavaroutsos (2009) argue that the construction of new energy efficient buildings on its own cannot significantly alter the impact of the buildings on the environment, unless the principles of green design are also adopted and applied to existing buildings. Tobias and Vavaroutsos (2009) further assert that globally, there is an under emphasis on the importance of existing sustainable building retrofits by green building practises. Green adaptive reuse prolongs a building's lifespan as well as lowering its carbon footprint, while at the same time contributing to the preservation of its cultural heritage (Langston, 2011).

Balaban and Puppim de Oliveira (2017) suggest that there are two key strategies that can be used to make buildings more sustainable or greener. The first one, which is a primary sustainability objective, is to construct new green buildings (Cidell and Cope, 2014). The second one is the sustainable reuse of existing building stock (Juan *et al.*, 2010). It is for this reason that Geraedts (2016) proposes that an adaptive building is a green building, the only issue is how to measure the greenness.

2.4 CHANGE IS INEVITABLE

Changes to buildings are always triggered by either changing environment or by changing needs of building users and/or property owners (Heidrich *et al.*, 2017). The needs of human beings are so complex and diverse that any change requires a system that is flexible to adapt to the changes (Schmidt III *et al.*, 2011). Generally, people spend approximately eighty percent of their time inside buildings and over time during the lifespan of buildings, the needs of the building occupants change (Gijsbers *et al.*, 2009). It is therefore, fair to expect buildings, as dwelling spaces, to be flexible in response to these changes (Gorgolewski, 2005).

Gijsbers and Lichtenberg (2014) propose that what often triggers change are user-independent and user-dependent drivers. Accordingly, user-independent drivers deal with external factors such as changes in the macro economy of an area or even changes brought about by technical innovations. User dependent drivers refer to factors such as changes in the demography or financial circumstances of people. In the same way in which the needs of human beings change and evolve over time, buildings also need to develop, grow and evolve in maturity, or else they will deteriorate (Gorgolewski, 2005).

According to Geraedts *et al.* (2014) causes of building demand changes can either be due to use dynamics or transformation dynamics. Geraedts *et al.* (2014) explain that use dynamics pertain to the

change in demand induced by the current users of the building to which the building should adapt, whilst transformation dynamics deals with the building being able to accommodate the needs of future users or changes triggered by the need to serve a different function, which may require reconfiguration of the building space.

Slaughter (2001) further explains the concept of change by suggesting that there are three basic changes a building can go through in its lifespan: (1) a building can either go through change in the functional use of its space or (2) a change in its load bearing capacity, or (3) changes in the flux of people occupying the building as well as environmental forces. Pani (2014) considers adaptable building as a valuable answer to the inevitable evolution of building inhabitants.

2.5 BUILDING ADAPTABILITY CONCEPT

According to Pinder *et al.* (2011) and Remøy *et al.* (2011) the knowledge of building adaptability, as a tool of extending usability and functional lifespan of buildings, has been in existence as far back as the 1960s. As early as the 1970s, various academic scholars have examined the concept of adaptability (Habraken, 2008).

Building adaptability is a concept that seeks to incorporate, during the design and construction stages of a building project, the ability to make changes in the future, in order satisfy evolving building needs of its occupants, with minimum effort and cost (Gorgolewski, 2005). An adaptable building, according to Etteh (2016), is structure which is designed, built and maintained with an idea in mind for ease of future conversion in order to satisfy new conditions and requirements. In essence, adaptability is the ability of a building to accommodate varied known and unknown future changes brought about by the changing needs of building inhabitants, at a minimum possible cost and effort (Kestner and Webster, 2010). According to Heidrich *et al.* (2017) adaptability of a buildings refers to two things: firstly, it can refer to the inherent properties embedded in the design and construction of a building that enable it the ability to change. Secondly, it can refer to the relative ease to which a building can by changed through external intervention.

Wilkinson *et al.* (2009) defines an adaptable building as one that is able to meet new user requirements easily by accommodating both the within-use changes and the across-use changes. A clear example of a within-use and across-use adaptation is given by Ellison and Sayce (2007). According to them, an example of a within-use adaptation is, for instance, when an office block undergoes adaptation that does not require a change in its use i.e. it remains an office, whilst an across-use adaptation happens, for instance, when an office block undergoes adaptation that completely changes its use to a residential apartment.

A building is said to be maladaptive if it fails to respond adequately to new building demands exerted by its occupants (Manewa *et al.*, 2016). Building adaptability is work that is done over and above maintenance work, in such a way that seeks to adjust, upgrade or even reuse a building, by altering its function, performance or capacity (Douglas, 2006). According to O'Connor (2004) change is inevitable during the course of a building's lifespan. The greatest value of adaptability is that it eliminates the need to predict or forecast what changes are possible to happen in the future, but rather acknowledges the difficulty and inability to foretell such information, by designing for change and material recovery (O'Connor, 2004).

2.5.1 Characteristics of Building Adaptability

The adaptive capacity of any building structure encompasses all the characteristics embedded in the building design that enable it to remain functional during its lifespan in a sustainable manner (Geraedts, 2016). The first and most overarching attribute of adaptability is the capacity to

accommodate change (Moffatt and Russell, 2001; Bullen, 2007; Schmidt III *et al.*, 2010; Gosling *et al.*, 2013; Pani, 2014; Shahbazi *et al.*, 2017). Every definition of building adaptability refers, to some extent, to the ability for change in some way, be it in terms change in size of the space or use, change in functionality or performance, or change in the capacity (Schmidt III *et al.*, 2010).

As innovations in technology in buildings rise, adaptability can, for instance, facilitate easier change overs to new systems, thus enabling the buildings to benefit from technological advancements quicker and at minimum costs (Moffatt and Russell, 2001). The price to pay for not considering future changes comes in the form of exorbitant refurbishments, disruptions and inconveniences to building users, and lost opportunities together with a greater likelihood of premature obsolescence of the building (Schneider and Till, 2005). The ability to remain fit for purpose is an essential characteristic of building adaptability (Ridder and Vrijhoef, 2008b). The importance of this attribute becomes apparent in fastmoving sectors such as in retail spaces and healthcare, where, in order to stay fit for purpose, there is a need for relatively frequent adaptation of spaces (Pinder *et al.*, 2013). It is not a rare sight to see units in retail shopping centres being refitted every three years or so, as a response to new tenants with different requirements renting the space or products being promoted (Pinder *et al.*, 2013).

According to Engel and Browning (2008) the ability to maintain property value is an important attribute of adaptability. Gibb *et al.* (2007) is of the opinion that there are new ways to own and manage property which have been opened by the concept of adaptability. According to Davison *et al.* (2006) adaptability affords property owners the opportunity to maximise returns, minimise costs and construction time by being able to change the mix use of space quickly in response to changed market conditions.

Time is an important characteristic of building adaptability, and is presented in two spheres of change (Schmidt III *et al.*, 2010). The first is the ability to readily and rapidly respond to change with minimum cost; secondly, time is used to indicate longevity or lifespan of a building (Schmidt III *et al.*, 2010). Adaptability can be used as a strategy for prolonging the useful lifespan of a building with minimum negative impact on the environment (Moffatt and Russell, 2001). This point is supported by Gosling *et al.* (2013) who emphasise that adaptability enables buildings to respond to change with minimum effort, time and cost penalties. All other things being equal, an adaptable building is likely to be efficiently utilised and be capable of a longer service life. The longer and efficient the service life a building has, the more it translates to better environmental performance during its lifespan (Moffatt and Russell, 2001).

2.5.2 Forms of Adaptability

Watson (2009) identifies three forms of adaptability: conversion, extension and refurbishment. Conversion involves work that changes the function or use of a building, such as an office block being converted to residential occupancy. Extension involves any work which expands the size of a building, whether horizontally or vertically. Refurbishment involves any work which seeks to change the performance of a building. Refurbishment can range from simple redecorations to extensive retrofit or complete rebuilding (Langston, 2008). Heidrich *et al.* (2017) suggests that regular maintenance and repair works of a building does not constitute adaptation.

Arge (2005) describes the concept of adaptability in terms of (1) Generality: the ability of a structure to respond to the evolving functional user requirements without changing its building properties, (2)Flexibility: the ability of a structure to respond to evolving functional user requirements by easily changing its building properties, (3) Elasticity: the ability of a building structure to be extended or partitioned in response to evolving user requirements. In the definition of adaptability “frequently,

terms like ‘renovation’, ‘refurbishment’, ‘remodelling’, ‘reinstatement’, ‘retrofitting’, ‘rehabilitation’, and ‘recycling’ of buildings are incorporated” (Wilkinson *et al.*, 2009: p46).

2.6 DESIGNING FOR ADAPTABILITY

Designing for adaptability is a principle that is concerned with extending the longevity of a building by enabling it, at the design stage, to meet future changing circumstances (Kasarda *et al.*, 2007). Carro Saavedra *et al.* (2014) refer to it as a design paradigm seeking to produce designs and products that are easily adaptable to various requirements. Design for adaptability essentially lays the fundamental set of design principles and theories for sustainable use of materials, in a similar way bio-climatic design sets sustainable energy use principles and theorems (Graham, 2005). The capacity of a building to meet future changing conditions is intrinsic to the multitude of initial architectural design decisions which are made early in the design development stages (Engel and Browning, 2008).

Designers have a growing challenge, as the critical issue of sustainability and re-use is becoming apparent, to design buildings for future change in such a way that will facilitate reduction of risk, future costs and effort (Schmidt III *et al.*, 2011). Implementing the principles of adaptability at the design stage of project development enables technical changes in the future to be undertaken with minimum cost and effort, thereby making refurbishments and conversions financially viable (Gijsbers and Lichtenberg, 2012). If, however, the aspect of future change is not incorporated in the planning phase, changes in the future may result in intensive costly construction methods, that in worse cases, may lead to premature demolition of buildings (Marciniak, 2015). In a sense, designing for adaptability is a proactive design initiative rather than being reactive to inevitable future changes later in the future (Naim *et al.*, 2006). The degree to which spaces within a building can be re-configurated is dependent on what pre-configuration was provided on the building (Heidrich *et al.*, 2017).

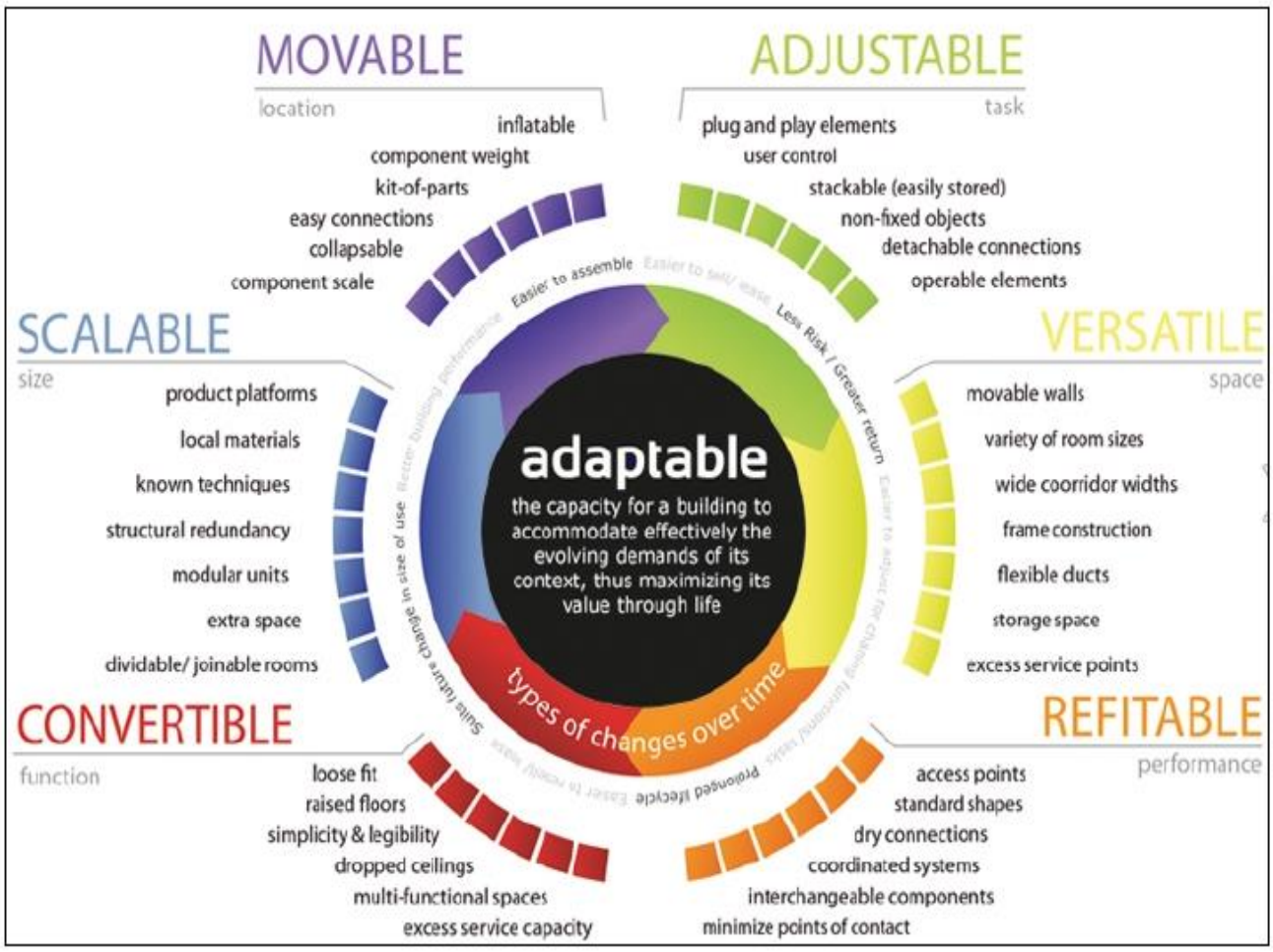
Architecture that is open to the idea of adaptability as well as being capable to anticipate and be accommodative of the needs and desires of the building occupants, is a challenge to the growth of sustainability developments (Pani, 2014). Design for adaptability encourages greater innovations in the process of designing new buildings (Manewa *et al.*, 2009b). However, because of various regulations and traditions, the present tendency is to design rigid structures, with a specific idea for single use, which results in buildings that are difficult to adapt to the ever changing needs of building users (Unzurrunzaga and Branchi, 2013). Most of the existing buildings at present, were not designed to match both the requirements of existing users occupying the buildings and future generations to come (Pinder *et al.*, 2013).

According to Bullen and Love (2011b) single-use structures that are designed for a specific functionality are difficult and costly to retain and adapt. The reality is that “buildings are built with yesterday’s technology and today’s ideas for tomorrow’s people” (Ridder and Vrijhoef, 2008b: p1166). Adaptability is rarely embraced as a full embodied principle of designing buildings because often adaptability elements are brought in a haphazardly, unplanned and fragmented manner when the need arises (Schmidt III *et al.*, 2010).

Li *et al.* (2008) emphasises that, for reasons of environmental and economic purposes, there is a growing need to inculcate building adaptability as a design principle, in order to produce buildings that are suitable for current and future use, in a way that will enable diverse needs of occupants to be meet with minimum inconvenience. Gorgolewski (2005) urges designers to be cognisant of the effect of time on buildings, and the fact that buildings inevitably will go through different changes over their lifetime.

The value of design for adaptability is that, firstly, it enables easy modifications and improvements during the useful life of a building, and secondly, it makes possible to recycle and reuse building materials at the end of its lifecycle because such materials would have been chosen for their reusability and ease to deconstruct for reuse to begin with. However, not every building needs to be designed for adaptability. Structures that are not likely to change their functionality over their lifespan, such as museums and cathedrals are less likely to profit from the design for adaptability concept because the possibility of such buildings remaining static over their lifespan is high. Another example of buildings that are difficult to adapt and less suitable to benefit from designing for adaptability are buildings with a short lifespan such as commercial strip malls, hence such buildings are best designed for easy de-constructability and material reuse. (Kestner and Webster, 2010). Figure 2.2 below shows the objective of design for adaptability.

Fig 2.2: Design for adaptability strategies



Source: (Manewa *et al.*, 2013: p7)

2.7 FLEXIBILITY

Depending on the context used, flexibility is a broad term with varied meanings (Gijsbers and Lichtenberg, 2014). In general flexibility can be defined as the ability and potential to which a building can be modified and rearranged to respond to change (Estaji, 2017). An inflexible building layout

effectively reduces its useful life (Langston, 2008). The more flexible a building is, the more easier a building is able to adapt to changes, which results in savings in terms of time and productivity loss (Boehland, 2003). Ellison *et al.* (2007) argues that the buildings which do not have flexible abilities have relatively less value compared to adaptable buildings because they are more costly to retrofit in the future.

Although the building industry has embraced the use of flexibility as a strategy to extend functionality of buildings, historically, its application and implementation of flexibility remains random and less successful, according to Gijsbers and Lichtenberg (2014). They further suggest that there are two reasons for this slow uptake. Firstly, it is difficult to predict how, in the long run, demand will change. Secondly, even at times when users of a building are able to explicitly express their needs, the challenging difficulty remains in determining technical design solutions that would appropriately match those demands.

Flexibility in building projects is two dimensional: it is either process or product based (Olsson, 2004; Geraedts, 2006; Gijsbers and Lichtenberg, 2014). Process flexibility is the flexibility applicable during early stages of design development and refers to the flexibility in making design decision during the project development stage (Olsson, 2004; Lans and Hofland, 2005). It is of paramount importance, as early as possible, to determine a level of flexibility in the building design, that will appropriately and adequately respond to possible user requirement changes in the future, because confronting them early simplifies decision making later (Israelsson and Hansson, 2009).

Product flexibility is applicable in the user and operational stages of a building and basically refers to ease at which changes can be made to an existing building in order for it to adapt to changing user circumstances and requirements (Van Herwijnen, 2000). A clear distinction is given by Geraedts *et al.* (2014: p5) in that "process flexibility - the capacity to react to changing circumstances, wishes or demands during the initiative, the design and construction phase. Product flexibility - the capacity to respond to changing circumstances, wishes or demands during the use phase of the building." According to Gijsbers and Lichtenberg (2014) the usefulness of all the technological innovations applied in the design of adaptable building structures is of value only if they are effectively contributing to flexibility in use.

The importance of flexibility is that it enables a building to have the potential to adjust well to changes in its functionality by current building users or be functionally accommodative to requirements of different future building users (Ye *et al.*, 2009). The more uncertainty there is about the nature of demand, the more beneficial building flexibility becomes (Ye *et al.*, 2009). Therefore, building flexibility can be seen as something that allows building users to have options on how they use their space rather than having spaces that are architecturally predetermined with no room for change (Schneider and Till, 2005).

2.8 OBSOLESCENCE IN BUILDINGS

Obsolescence in buildings measures the extent to which a building lacks utility (March *et al.*, 2012). It is described as a gradual condition that eventually results in a building being unable to meet contemporary standards functionally, economically, physically, or even statutorily (Butt *et al.*, 2015). At the core of the idea of something being obsolete is the realisation that, usefulness is no longer in existence (Grover and Grover, 2015). Obsolescence can also be regarded as the onset of the end of a building's life and, without cure, will eventually lead to the end of its service life (Thomsen and Van der Flier, 2011). Butt *et al.* (2015) go on to explain that it is not necessarily the age of a building that lends to obsolescence, but rather the lack of response to change. Examples of where the age of a

building does not result in obsolescence could be, for instance, heritage buildings such as shrines, monuments, museums, because such structures actually become more functionally useful as they age.

Thomsen and Van der Flier (2011) is of the opinion that obsolescence poses a serious threat to the built environment, hence it is essential that designers, developers and facility managers have professional skills to minimise obsolescence, especially given that buildings are immobile, have long lifespan and also require highly intensive capital investment. However, obsolescence does not necessarily have to be a condition that justifies demolition, because there are ways of treating it to extend the building lifespan, such as refurbishment and reuse (Thomsen and Van der Flier, 2011). Manewa *et al.* (2016) recommends adaptive reuse as a strategy to cure obsolescence and revitalise building stock. Heidrich *et al.* (2017) concurs that adaptable buildings are slowly emerging as a practical and strong solution to deal with the problem of obsolescence of buildings.

2.8.1 Types of obsolescence

Buildings become obsolete either because they no longer satisfy user needs (functional obsolescence), or they no longer provide safety and comfort to building users (technological obsolescence), or they are physically deteriorating (physical obsolescence), or when they can no longer be profitably operated (economic obsolescence), (Gijsbers and Lichtenberg, 2014). Building adaptation may be required when a building reaches a certain level of redundancy (March *et al.*, 2012).

2.8.1.1 Functional Obsolescence

Obsolescence will set in when a building is inappropriately used relative to its original purpose or when the demand for the space requirements has changed (Langston, 2008). Functional obsolescence occurs when a building can no longer serve the function for which it was originally designed, usually due to change in the needs and expectations of the building occupants (Butt *et al.*, 2015). It is the end users that will eventually value the quality of the functionality of a building, hence user satisfaction is a crucial pointer of functional obsolescence (Gijsbers and Lichtenberg, 2014). According to Manewa *et al.* (2009a) a lot of buildings are designed to have a long and strong structural integrity but tend to suffer from functional transitions throughout their lifespan. To optimise building functionality Gijsbers and Lichtenberg (2014) advise that buildings should be custom designed and constructed to meet future user demands. Designing buildings to perform predictable functions is inadequate and leaves buildings susceptible to obsolescence (Ross *et al.*, 2016).

Functional obsolescence can be determined by the level of flexibility embedded in the building design, thus functionality is compromised by inflexible building technology (Langston, 2008). The consequence of a building being ill fit for its purpose is that it is likely to remain vacant until it finds correct use, which in turn may lead to the vulnerability of social security through criminal elements and vandalism of the building (Manewa *et al.*, 2016). Visual symptoms of social insecurities and uncertainty are seen through illegal occupancy, and vandalism and graffiti which may eventually lead to deterioration and devaluation of the property (Remøy and van der Voordt, 2007; Wilkinson and Remoy, 2011). According to Gijsbers and Lichtenberg (2014) functional obsolescence is the most common reason that buildings fail to reach their full lifespan, and hence, it is important to incorporate adaptive elements in the building design that would enable extended use or possible upgrades in a cost effective manner (Van Nunen, 2010; Manewa *et al.*, 2016).

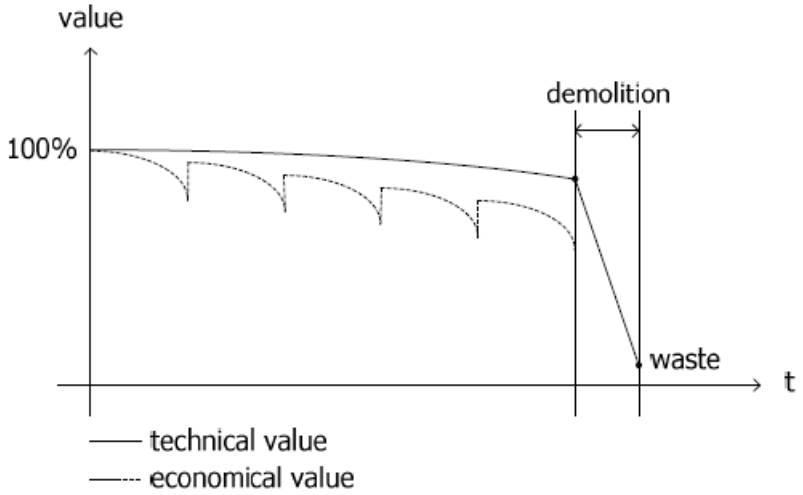
2.8.1.2 Physical Obsolescence

This type of obsolescence occurs as a result of physical decay and degradation of the fibre of a building structure (Mansfield and Pinder, 2008). Physical obsolescence, sometimes known as technical obsolescence, is often triggered by use of poor quality building materials or inadequacy in the method of construction implemented (Grover and Grover, 2015). The state of physical obsolescence can be examined and determined by examining the maintenance policy and performance of a building because useful life is challenged and minimised if a building is poorly maintained (Langston, 2008). Physical obsolescence usually manifests itself by incessant wear and tear of the fibre of the building structure (Barras and Clark, 1996).

2.8.1.3 Economic Obsolescence

Economic obsolescence occurs when a building, regardless of its physical state, cannot be operated in a financially viable manner (Butt *et al.*, 2015). Economic metrics that are indicative of economic obsolescence are elements such as declining property values, reduced revenue and investment returns from property (Grover and Grover, 2015). A distinctive feature about this type of obsolescence is the inability of a building to be operated at a profitable level (Barras and Clark, 1996). A building is said to have reached economic obsolescence when its current use ceases to be least cost alternative (Gorgolewski, 2005). A different way of viewing economic obsolescence is given by Mansfield and Pinder (2008), as a situation where the operation of a building is no longer the highest and best use for that space (Mansfield and Pinder, 2008). Ridder and Vrijhoef (2008b) argues that the economic lifespan of a building is significantly shorter than the physical lifespan, hence it is likely to contribute to the cause of obsolescence more than any other types of building obsolescence. Figure 2.3 below shows how the economic value of building depreciates compared to the technical (physical) value, with time.

Fig 2.3: Technical & Economic Obsolescence



Source: (Ridder and Vrijhoef, 2008a: p1166)

2.8.1.4 Technological Obsolescence

Sometimes there are situations where a building is in good physical condition but has outdated services and technology (Langston, 2008). Building obsolescence can also be caused by advancement in technology, which usually provide occupants with better experiences and lifestyles (Grover and Grover, 2015). One of the ways of measuring technological obsolescence, as suggested by Langston (2008), is the use of operational energy in a building because reliance on high energy levels to provide comfort to occupants when there are innovative cheaper ways of providing the service, effectively reduces useful life of a building. However, according to (Gorgolewski, 2005) most of the times buildings do not reach technological obsolescence, rather they are replaced due to evolving user needs (functional obsolescence), or due to economic obsolescence.

2.8.2 Lifespan of Buildings

The full lifespan of a building is composed of three different lifespans: namely the physical, economic and functional lifecycle (Van der Voordt, 2004). However, the shortest type of lifespan is what determines the ultimate useful lifespan of a building (Gijsbers and Lichtenberg, 2014). Kestner and Webster (2010) estimate that the lifespan of most buildings, which are traditionally built to be around 50 years, yet for reasons other than degradation of materials, most buildings are demolished long before they reach their full lifespan. Gijsbers (2006) expounds further that a building constructed in a traditional fashion is expected to have a technical lifespan of between 50 – 100 years, but will most likely be demolished after 20 – 30 years, mainly due to economic considerations. It is difficult to forecast building life and that is the reason it is important for buildings to be designed for long-term use in order to ensure that they do not end up being prematurely demolished (Kestner and Webster, 2010).

Langston (2008) suggests that until recently, decisions on whether or not to demolish buildings were mostly influenced by economic considerations, a reason that has resulted in premature demolitions. Bullen and Love (2011a) provide a different perspective to the issue of premature demolitions by suggesting that, the perception of old buildings being inefficient structures that simply need to be disposed of and replaced, is at the root of premature demolishing of building. It is however, encouraging to note that there are signs this mindset is gradually dying, as the prominence of adaptive reuse strategies is growing (Langston, 2008). There is a shifting trend in the built environment towards adaptive reuse and adaptation in place of demolition (Bradley and Kohler, 2007).

Demolishing buildings prematurely and reconstructing impacts negatively on the environment because firstly, the disposal of the demolished material affects the environment negatively, and secondly, rebuilding entails extraction, manufacture and transporting of materials to site, which impacts on the environment by increasing gas emissions and energy consumption (Kestner and Webster, 2010). It is for this reason that Itard and Klunder (2007) regard demolition as a wasteful and unfriendly process to the environment. According to Gijsbers (2006), the act of demolishing a physically fit building is nothing but capital destruction that brings with it complicated side effects of material wastage, carbon dioxide gas emission and energy consumption.

Bullen and Love (2011b) consider a decision to demolish a building premature, if no consideration is made on how adaptive reuse could be used to optimise residual utility and value of the building. Demolition is often a preferred choice when it is anticipated that the existing building's life expectancy would be less than an alternative building option regardless of any investment in adaptive reuse improvements (Bullen and Love, 2011b). Adaptive reuse is a better alternative to demolishing and rebuilding because relatively, it generates less energy consumption, gas emissions and wastage (Conejos *et al.*, 2011).

2.9 ADAPTIVE REUSE OF BUILDINGS

Adaptive reuse is a process improves the performance of old existing buildings by converting them to suit new requirements and conditions (Bullen and Love, 2011a). Van Nunen (2010) advises that for adaptive reuse to be possible, it is important that buildings are designed and constructed with flexibility to allow for extended use and ease of upgrade and conversion, in a cost-effective manner. When designing and constructing new buildings, it is important to consider how they are going to adapt to future changes (Sheffer and Levitt, 2010). Adaptive reuse is what happens when a functional obsolete building that is no longer fit for its purpose is converted to a new functional use and purpose altogether (Langston, 2008). Adaptive reuse is a development process that breathes new life into older buildings (Shen and Langston, 2010), by revitalising them into new viable uses (Kurul, 2007).

A major decision that confronts a lot of building owners is whether to demolish or adapt and reuse existing building facilities (Bullen and Love, 2011a). The basic premise of constructing adaptable buildings is to enable them to be easily upgraded and converted later, to meet future building requirements, with minimum financial cost damage to the environment (Pinder *et al.*, 2013). Kohler and Yang (2007) argue that it is easier, quicker and cheaper to retrofit an adaptable building than a building constructed in a traditional way.

The reason building adaptability and adaptive reuse is receiving widespread attention is because it has environmental, economic and social benefits (Cooper, 2001; Kohler and Hassler, 2002; Bullen and Love, 2011a). Environmental sustainability pertains to improvements in the efficiency of materials and resources, economic sustainability involves reducing operational costs of a building, and social sustainability refers to the preservation and retention of existing buildings (Cooper, 2001). A sustainable society is impossible to achieve until the key resource, of existing building stocks, can be managed in a sustainable manner because it represents the greatest asset financially, physically and culturally (Moffatt and Russell, 2001).

Old buildings sometimes have a specific character, style and architectural history that significantly shapes the culture and heritage of a society, that has social value which may need to be preserved (Langston, 2008; Bullen and Love, 2011b). This is how adaptive reuse becomes socially sustainable because it helps to retain and preserve the style and character of old buildings (Ball, 1999). As a strategy to revitalise and promote sustainability, many buildings of historical significance and cultural heritage are being adaptively reused instead of being demolished (Wilkinson *et al.*, 2009), hence Bromley *et al.* (2005) advocate adaptive reuse as a method that essentially conserves heritage. A study conducted in UK concluded that even at times when the economic costs of adaptation are too high, consideration of environmental and social benefits can sway the decision towards it as a better choice compared to demolition and reconstruction (Ball, 2002). Remøy and Van der Voordt (2014) also highlights that over and above minimum income disruption, there is also a social gain aspect in that adaptive reuse may result in reaping the benefits of the location and building.

Adaptive reuse is more environmentally sustainable over traditionally constructed buildings because it produces less embodied energy as a result of, firstly, there is a reduction in waste during construction, and secondly, the methods uses less building material and fewer delivery loads to site (Collins *et al.*, 2010). In other words, adaptive reuse is environmentally sustainable because it consumes less resources due to reduced pollution during construction as a result of less demolition involved, less transport energy because of reuse of building materials and fewer delivery loads, and less energy consumption because of improved building operations and a reduction in the manufacture and installation of new raw materials (Bullen, 2007). Another reason adaptive reuse is environmentally sustainable is because it allows the reuse of building materials, which subsequently, results in

significant savings in embodied energy, that would have, otherwise, been wasted by demolition (Reddy and Jagadish, 2003).

From an economic perspective one of the reasons for the growing attention is the increasing perception that is cheaper to convert older buildings to new use, than to demolish and reconstruct (Ball, 2002; Gregory, 2004; Kohler and Yang, 2007). Shipley *et al.* (2006) explain that firstly, there is a saving in cost and time because the structural framework of the building already exists, and hence construction tends to be quicker, and secondly, there is a potential reduction in the cost of borrowing money to fund adaptive reuse projects due to reduced periods of construction (Watson, 2009; Wilkinson *et al.*, 2009). Klunder (2005) provides a different opinion about what qualifies adaptive reuse to be cheaper than demolishing and replacement. Accordingly, adaptive reuse is a preferred choice over demolition as long as its use results in sustainable environment and a reduction in energy consumption. Bullen and Love (2011a) is of the opinion that adaptive reuse can only be cheaper than demolition and rebuilding as long as the external fabric of a building is still intact and structurally sound, otherwise if that is not the case, significant challenges may be experienced if reuse is to be adopted. Another key economic reason for there being value in designing adaptable buildings is that it helps to reduce the whole lifecycle costs of a building by enabling easy and less costly modifications post construction (Arge, 2005; Manewa *et al.*, 2016).

Remøy and van der Voordt (2007) argue that vacancy in property is problematic at different levels. Firstly, it is problematic economically because it leads to loss of income to property owners and, secondly, it is problematic socially because it produces a sense of uncertainty and social insecurity that may attract criminals, vandalism and illegal occupations of abandoned buildings. Adaptive reuse also helps in revitalising existing neighbourhoods as well as control urban sprawl (Bullen, 2007). Furthermore, Bullen (2007) asserts that building adaptation is a significant component of urban regeneration that benefits future generations. According to Yau *et al.* (2008) adaptive reuse improves the negative visual image of old buildings. Bromley *et al.* (2005) suggest that essentially, adaptive reuse is a regeneration strategy, used by municipalities to deal with redundant commercial buildings. Buildings that cannot be adapted may ultimately be obsolescent and become a blight in the landscape and cause significant social and environmental costs when they are eventually demolished (Pinder *et al.*, 2013).

Continual improvement is one of the aims of sustainability, and therefore it is not surprising that improving old buildings by the process of adaptive reuse is considered an effective sustainability strategy (Bullen, 2007). Bromley *et al.* (2005) supports this view by adding that reuse of existing building stocks has the best ability, within the next two or three decades, to significantly reduce the environmental load. Sustainability is the key driver for recycling buildings (Ball, 2002), hence improving the performance of existing building stock by adaptive reuse is crucial in achieving this goal (Cooper, 2001).

The manner in which built environment supplies building space tends to be wasteful because it is common to have an oversupply of office space, for instance, whilst there are excessive vacancies in residential housing, or vice versa (Davison *et al.*, 2006). This inevitably drives clients to look for alternative ways of designing property that would minimise loss of potential rental income whilst preserving resources consumption (Shawn Burke *et al.*, 2006). Converting redundant spaces into other functional uses is a valuable way of reducing vacancy levels (Remøy *et al.*, 2011).

One of the fallacies about improving the sustainability of buildings is that most of the initiatives tend to focus on new developments rather than buildings that already exist, because of the common perception that the useful life of old buildings is limited and destined to be discarded and demolished

eventually (Bullen and Love, 2011b). In many cases extending the lifespan of a building through adaptive reuse also results in reduced consumption of materials, transport and energy as well less pollution during construction, thereby contributing significantly to the sustainability agenda (Gregory, 2004; Bullen, 2007; Velthuis and Spennemann, 2007; Bullen and Love, 2009),. Since most of the existing buildings were not constructed to be environmentally sustainable, the environmental gap that exists can be closed by adaptively reusing existing building structures in order to improve their performance and reduce the environmental loading (Bullen and Love, 2011a). Kohler and Hassler (2002) argue that there is increasing support which suggests that adaptive reuse fulfils a major criterion of sustainability.

2.10 BARRIERS TO ADAPTABILITY AND REUSE

Regardless of how well an old building has been adapted, its performance may not match that of a new building (O'Donnell, 2004). The age of materials of a building to be adapted, as suggested by Bullen and Love (2011a) directly affects the cost of building maintenance. Hence, Bullen and Love (2011a) advises that adaptive reuse may be more costly and less beneficial in cases where the fabric material of the older building has short lifecycle expectancy compared to new construction. When a building is in a very poor physical condition, the cost of adaptive reuse may be so high that demolitions becomes a better option (Itard and Klunder, 2007). Often building owners and professionals are less eager to adopt adaptive reuse due to concerns around increased maintenance, spatial layout inefficiencies, commercial risk and uncertainty (Shipley *et al.*, 2006; Kurul, 2007; Remøy and van der Voordt, 2007). However, O'Donnell (2004) suggests that consideration of such deficits should be balanced against the gain in social value that adaptive reuse gives.

According to Slaughter (2001) and Arge (2005) the additional cost involved in integrating adaptability into the building design presents a barrier to its implementation. However, that cost is a small fraction compared to the full lifecycle costs of a building as the inability to adapt comes with costs also, although many clients are concerned about the business case on the initial costs, thereby producing less motivation for designing for adaptability to cater for future changes (Schmidt III *et al.*, 2011). The cost of adapting a building to meet new requirements may include loss of rental income for a while whilst the building is being transformed, inconveniences and disturbances to building users (Pinder *et al.*, 2013). The notion that designing and constructing adaptable buildings is costly is also fuelled by the fact that sometimes designers over specify design elements in an attempt to future proof buildings for future unknown changes (Pinder *et al.*, 2013). The real challenge designers face is how to design for adaptability without unnecessarily creating redundancy with unduly costs (Gibb *et al.*, 2007). According to Pinder *et al.* (2013) uncertainty and inability to predict future needs is at the root of overspecification by designers.

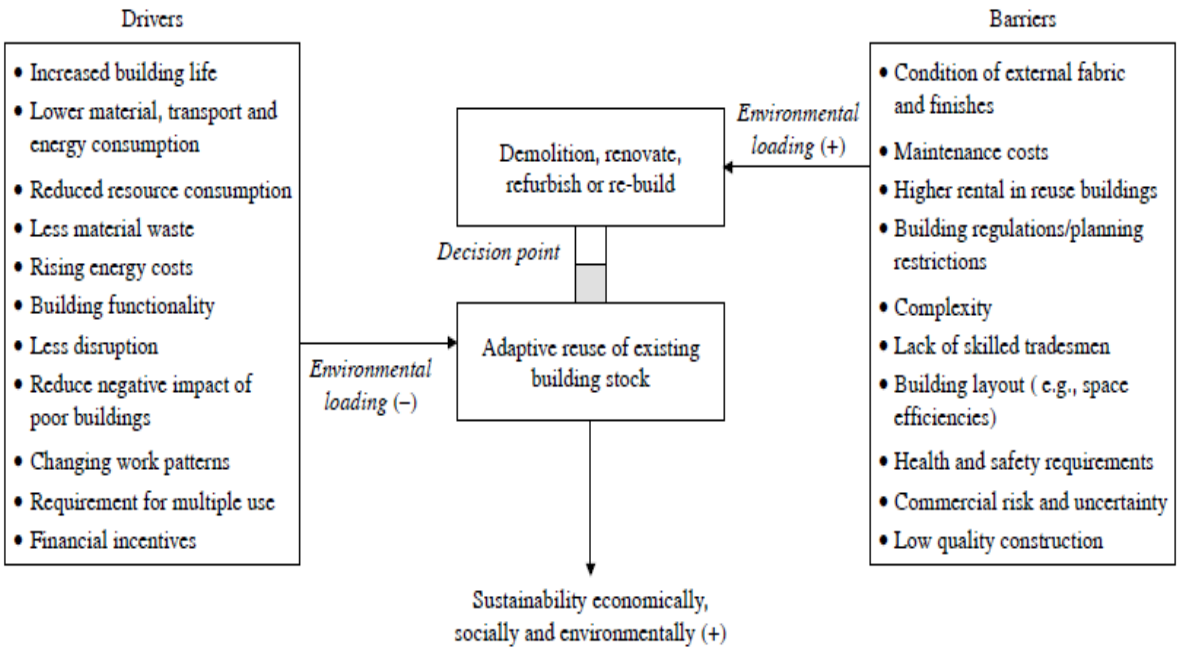
The client's influence and expectation present another barrier because it is not easy to convince them of the benefits of building adaptation if those benefits are going to result in an increase in the initial capital costs, because most clients are not drawn to the idea of adaptability with higher initial costs (Eguchi *et al.*, 2010). This is especially so with private clients who have inflexible budgets and who are not concerned much with environmental sustainability issues (Eguchi *et al.*, 2010). For investor clients who have a short-term interest in the building, increased initial capital costs due to adaptability are aggravated by the fact that, ultimately, the benefits of adaptability will be reaped by the building end users rather than the client who bore the development costs (Arge, 2005).

Rezoning and compliance to new building codes is often a challenge to overcome in adaptive reuse projects because changing the building use may alter the classification and zoning of the building (Langston, 2008). The underlying reason for adapting an older building is to improve its performance

and ensure that it complies with current building codes and standards (Cooper, 2001). Inflexible building codes and regulations regarding adaptive reuse are often a source of frustration to developers (Shipley *et al.*, 2006).

The attitude of professionals in the built environment can also be a deterrent to building adaptability. Gregory (2004) argues that adaptive reuse to many architects and other professionals in the building industry still remains an anathema. Part of the reason for this attitude is that many architects perceive adaptation of older buildings to new use as less prestigious, and inhibitive to their design creativity (Bullen and Love, 2011a). Kroll (2015) further explains that the reason for this discomfort is chiefly because the self-image of architecture has traditionally prided itself on new design creations rather than adopting older building designs into new ones. Nakib (2010) suggests that architecture should be more embracive to the notion of adaptability and flexibility in order for it become more effective in offering relevant solutions that respond adequately to the needs of society. Moreover, Bullen and Love (2011a) further argue that often it is the constraints and challenges encountered by architects and other designers that birth creative innovations of significance in society. Figure 2.4 below illustrates the different drivers and barriers to adaptive reuse of buildings:

Fig 2.4: Drivers & barriers of adaptive reuse of buildings



Source: (Bullen and Love, 2011a: p35)

Another obstacle to building adaptation is that property valuations do not adequately reflect, acknowledge or reward adaptability innovations, such as the ease to which a building can be retrofitted in the future (Ellison and Sayce, 2007). Pinder *et al.* (2013) credits this to the lack of empirical evidence of adaptability benefits, whilst Bullen (2007) attributes it to the lack of point of reference for building owners and professionals to justify the decision making and choice for its adoption (Bullen, 2007). Whilst property valuations have a crucial role of being surrogates for prices in the property market, they can also be an deterrent to innovations (McAllister, 2009). The reason for this is that property values are derived from past similar transactions and so if no apparent evidence exists from past transactions that indicates a rise in property value due to the inclusion of a particular design attribute in a building, then property valuers become reluctant to value such design

innovation (Pinder *et al.*, 2013). This inevitably leads to a vicious circle of blame where property investors are not keen to invest in the development of adaptable building because they believe that they are not profitable since there is no demand for them, whilst developers are not constructing them because they blame property investors for not funding their development. On the other hand investors point a finger back to property valuers for lack of incentive in funding adaptable building, whilst property valuers lament over the fact that there is no history of past transactions to demonstrate how adaptability added value because property developers are not constructing them, hence the blame circle perpetuates. (Pinder *et al.*, 2011).

2.11 ENVIRONMENTAL ASSESSMENT TOOLS

Over the past few decades there has been a emergence and development of environmental assessment tools built for the building sector to aid in decision making and environmental performance assessment of buildings (Haapio, 2012). Environmental assessment tools, sometimes known as building assessment systems, are tools used to assess, rate or rank, how buildings address environmental concerns compared to the ultimate goals (San-José *et al.*, 2007; Wu and Low, 2010). The objective of these assessment tools is to create standards and benchmarks for green buildings (Retzlaff, 2008), in order to ascertain objectively the level of greenness of buildings (Gunnell *et al.*, 2009). Rating tools also provide an effective framework for evaluating the environmental performance of buildings and incorporating sustainable development into the processes of building construction (Cole, 2005; Vyas and Jha, 2018). Put simply, these rating tools measure the sustainability of buildings (Burnett *et al.*, 2005; Vyas and Jha, 2018).

The leading green building assessment systems today are "Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM) and Green Star" (Roderick *et al.*, 2009: p1167). It is important to note that these assessment tools are not mandatory but rather voluntary and are designed to suit specific climatic conditions and requirements of different countries since green building assessment criteria vary for different countries (Zuo and Zhao, 2014).

According to Wang *et al.* (2016), the suitability and adequacy of the current green building rating systems in mitigating greenhouse gas emissions is questionable because of the lack of full lifecycle assessment of gas emissions. Building assessment systems have different areas of focus, which include energy efficiency, building materials, conservation of water, indoor environmental quality, management of waste, etc (Retzlaff, 2008). According to Cole (2005) there has been a call by architects, building contractors and developers for a change in building assessment systems in order to fully address wider sustainability issues. Gunnell *et al.* (2009) argues that most environmental assessment tools used to assess buildings are not truly sustainable because they do not strive to assess and measure the social and economic impact of buildings. Accordingly, the social sustainability criteria measures the impact of a building on the comfort of the occupants, access to the building, occupational health and safety, whilst economic sustainability criteria measures the impact of a building on the "local economy, efficiency, adaptability, ongoing costs and capital costs" (Gunnell *et al.*, 2009: p9)

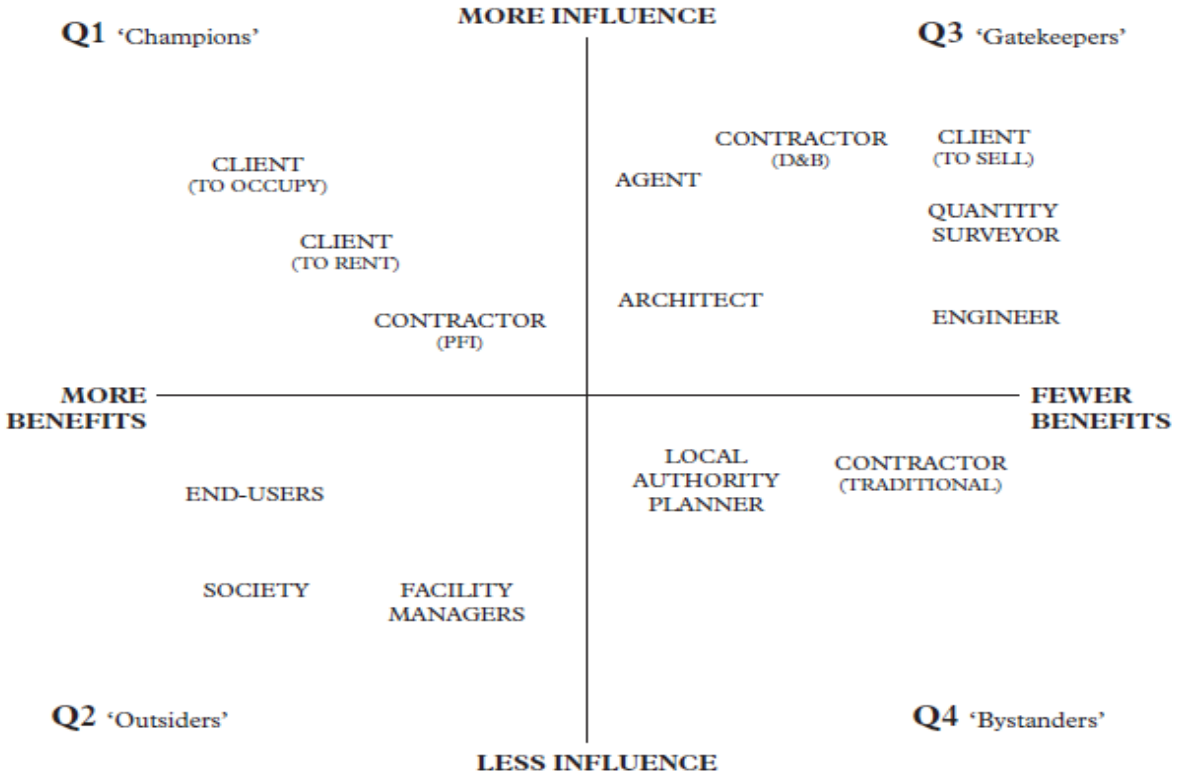
South Africa uses the Green Star SA rating system as a tool to assess the impact of buildings on the environment (Cousins, 2011). It is a rating tool which originated in Australia that South Africa adopted and customised to suite local conditions and requirements (Roderick *et al.*, 2009; Cousins, 2011). The Green Star environmental assessment tool was developed and is being managed by the Green Building Council of South Africa (GBCSA) as a voluntary instrument to measure green buildings in South Africa (Hankinson and Breytenbach, 2013). The Green Star tool has nine categories with different credits

within each that reward specific aspects and action of green buildings. The nine categories are Management, Indoor Environment Quality (IEQ), Energy, Transport, Water, Materials, Land use & ecology, Emissions, and Innovation. (GBCSA)

2.12 STAKEHOLDER INFLUENCE AND PERSPECTIVES

There is a wide range of stakeholders with varying interests and concerns involved in the building of a project (Ye *et al.*, 2009), hence it is important to understand their perspectives. Olander (2007) defines a stakeholder as a person or group of people who are influential to the outcome of a project, or can also be a group of people who do not necessarily have influence but who are impacted by the project and therefore have a vested interest in it. Figure 2.5 below is an illustration of the different project stakeholders with regards to their level of interest and benefits derived from a project.

Fig 2.5: Types of project stakeholders

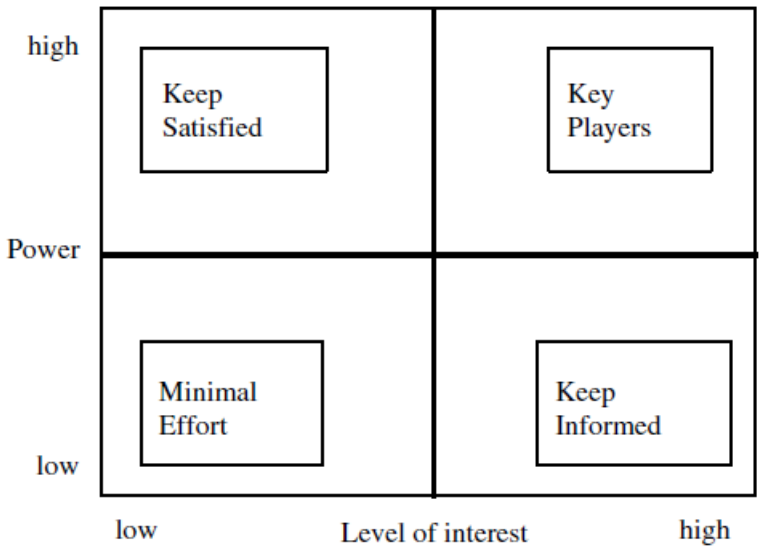


Source: (Pinder *et al.*, 2013: p448)

According to Pinder *et al.* (2013) there are four types of stakeholders involved in a building project. The first group known as Champion is composed of influential people to the success of a projects, who also stand to benefit from it. Typically, this would be the client who initiated the project. The second group of stakeholders is the Gatekeepers, who are people or organisations that have a great influence on the outcome of the project but have less personal benefit or loss from its outcome. Typically, these are project stakeholders such as the project professional team, which may be composed of Architects, Engineers, Quantity Surveyors, etc. Bourne and Walker (2006) further defines project stakeholders as a group of people who have an interest in the project and have a direct contribution, in the form of knowledge and/or support, that has an impact on the project. According to Aapaoja and Haapasalo (2014) these stakeholders have a direct responsibility towards the project. The third group of

stakeholders as categorised by Pinder *et al.* (2013) are known as the Outsiders. These are groups of people with little influence on the project but who are most interested in its outcome because of the benefit they derive from it. Typically, these are the end users, local communities and general society at large. It is important to maintain good communication with this group of stakeholders in order to keep them regularly informed of the developments in the project and earn their support (Newcombe, 2003; Aapaoja and Haapasalo, 2014). The last group of stakeholders are the Bystanders, who are a group of people with little influence and little gain from the project, such as authorities from municipalities, provincial and national government. However, it is important, for the progress of the project, to keep this group of stakeholders satisfied at all the times because often this group has statutory requirements that must be complied with and have the power to stop the project if they are not satisfied (Aapaoja and Haapasalo, 2014). The level of interest of Bystanders will remain low as long as they are satisfied. However, as soon as there is noncompliance and hence dissatisfaction on their part, their level of interest will quickly increase, and by virtue of their powerful position, may begin to influence the project (Newcombe, 2003). The following Table 2.2 illustrates the interaction of power and level of interest of different stakeholders in a project.

Table 2.2: Power/Interest Matrix



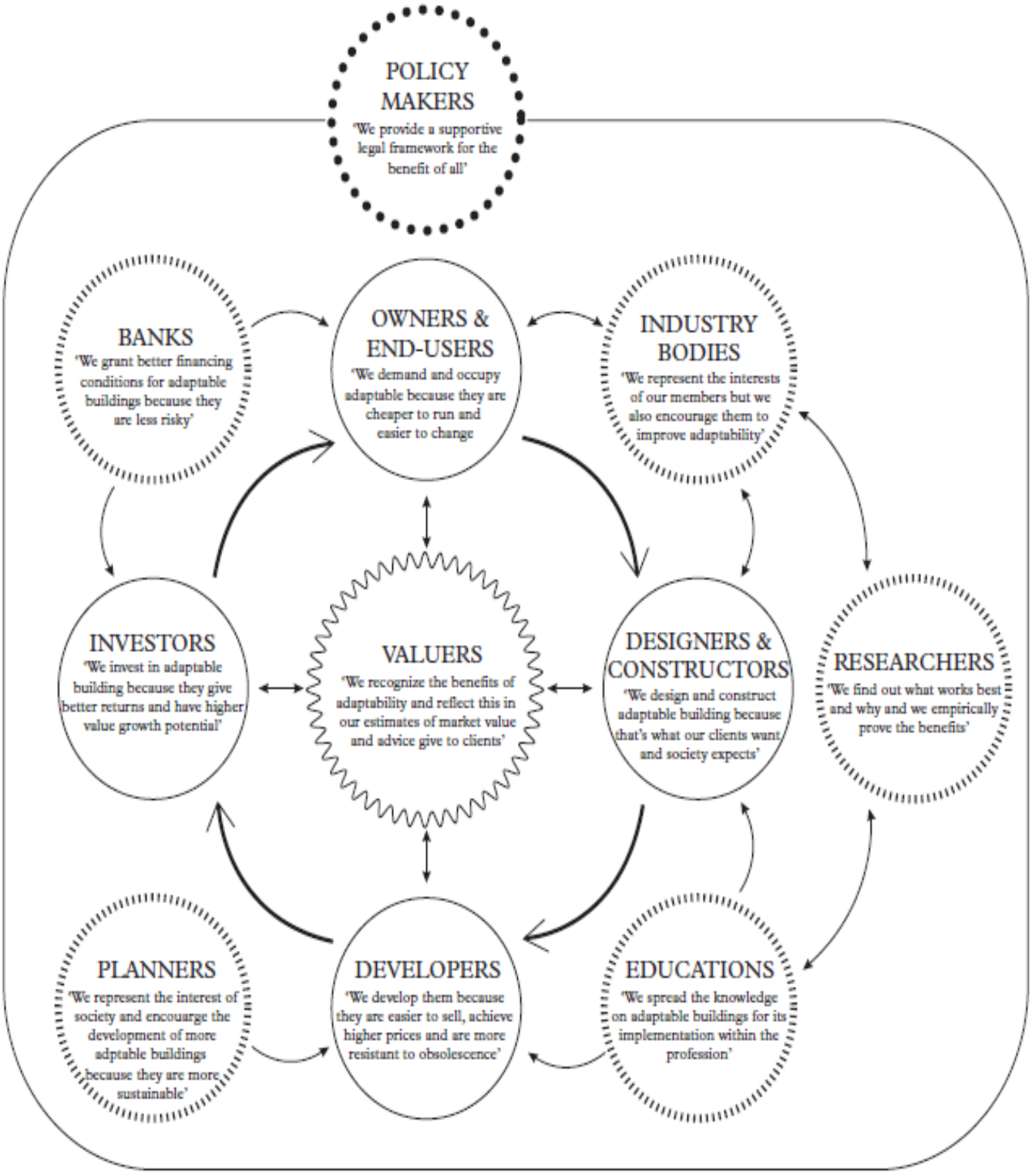
Source: (Olander and Landin, 2005: p322)

At various stages of project development, different stakeholders will express various, often conflicting interest (Olander, 2007). According to Arge (2005) understanding and identifying benefits different stakeholders have is important because this is what drives them. Geraedts *et al.* (2014) explains three different perspectives regarding demand change requirements of buildings. Accordingly, the societal perspective from the society views the use value of building as important and holds interest in the conservation of the heritage of the building for generations to come. The building owners and investors have an economic perspective and are interested in the building in the long-term profitability of buildings. The users' perspectives are centred on the functionality of the building, being able to remain fit for purpose to their needs.

Fragmentation of the construction industry gives rise to conflicting motivation and interests regarding adoption of adaptable buildings (Pinder *et al.*, 2013). To manage stakeholder expectations in terms of sustainability of buildings, it is important to understand which stakeholder bears the cost of sustainability and which stakeholder benefits from it (Arge, 2005). Property owners and developers

eschew adaptive reuse when they view buildings as short-term investments (Bullen and Love, 2011a). For instance, developers are motivated by profit have a short-term interest on buildings, and hence may not have an interest in developing sustainable adaptive buildings unless they perceive that such buildings would command a higher market demand and price compared to the traditionally constructed buildings (Arge, 2005; Remøy *et al.*, 2011). However, building owners, institutional investors and developers who have a long-term interest in buildings are motivated and interested in sustainable buildings because they may harvest the benefits in the future (Pinder *et al.*, 2013). The presence of multiple stakeholders and the fact that developers bear incremental costs whilst building occupants enjoy the benefits may lead to "split incentive and principle-agent problem" (Zhang *et al.*, 2018: p2235), as a result of a mismatch of the cost-benefit of sustainable building (Deng and Wu, 2014). The ideal situation that would benefit all parties is where all the stakeholders derive value in adaptive buildings such that they are eager to implement them, thereby creating a positive virtuous cycle of adaptable buildings as illustrated on Figure 2.6 below.

Fig 2.6: Creating a virtuous circle for more adaptable buildings



Source: (Pinder *et al.*, 2013: p455)

2.13 CHAPTER SUMMARY

In this chapter the link between sustainability of buildings and adaptability was discussed. Sustainability was viewed with broader holistic eyes includes environmental, economical and social sustainability. Environmental sustainability has to do with efficiency of materials, components, resources, etc incorporated in a building. Literature showed that adaptable buildings are environmentally sustainable because they use less energy and emit less carbon to the air because of less demolition. The reason is that adaptive buildings result in less embodied energy because of less demolition, less waste during construction, less building materials used and hence fewer delivery loads to and from construction site. Adaptable buildings are also environmentally sustainable because it can enable reuse of building materials because those materials would have been chosen for their recyclable properties to begin with.

Economic sustainability involves optimisation of resources in a way that minimises costs. Buildings that are designed and constructed to be adaptable are easy and less costly to retrofit when the need arises, making them economically sustainable. There is a savings in terms of cost and time it takes to construct a building as the construction durations are shorter, which might likely contribute to lower costs of borrowing money to fund the project. However, adaptive reuse can only be advantageous and less costly as long as the external building fabric is still intact and structurally sound.

Social sustainability pertains to the preservation and retention of existing buildings. The essence of adaptive reuse contributes to cultural heritage by converting existing buildings to new use thereby extending their functional and useful life.

However, the issue of sustainability is often perceived in a narrow, one-dimensional manner of environmental sustainability. It is for that reason that sustainability of buildings is synonymous with green buildings. Although green buildings answer to the call of sustainability of the environment Estaji (2017) asserts that any building that does not embrace the notion of change and reuse can only give an illusion of sustainability. Green buildings can be pursued either through new construction that is environmentally sustainable or through adaptative reuse of existing building stock.

The adequacy of environmental assessment tools was interrogated in terms of measuring adaptability of green buildings. This is because most of the current environmental assessment tools tend to focus attention to environmental sustainability with the neglect of social and economic sustainability. Even the assessment tools used in South Africa (Green Star), is not specific on the issue of measuring the level of adaptability of green buildings.

The chapter ends by assessing the interaction of various stakeholders with varying interests and influence, in promoting sustainability in the built environment. Stakeholders are motivated by different things and so they are less likely to pursue sustainability of building projects if they do not perceive benefits of them.

CHAPTER 3: RESEARCH METHODOLOGY

3.0 CHAPTER OVERVIEW

The objective of this chapter is to provide an understanding of how the research was conducted on the ground. Its purpose is to detail the practical steps that is followed in the process of conducting the research investigation. It is in this chapter that the school of thought which influenced the worldview and perception of the researcher in undertaking this research is explained. The research methodology and the methods of gathering information from which inferences were drawn are discussed on this chapter. Equally important, this chapter details how pertinent data to this research is to be collected, the tools used to collect it and the sources of data collection.

3.1 RESEARCH PARADIGMS

The general meaning of the word paradigm in research refers to either the approach or design of a research (Atieno, 2009). Paradigm is a theoretical framework of a research study that influences the way in which knowledge is studied and understood (Mertens, 2014). Research paradigm is also known as a research philosophy. It serves as a thinking guideline for the researcher in setting fundamental beliefs and suppositions as to how the researcher perceives the world (Jonker and Pennink, 2010).

According to Saunders (2011) ontology and epistemology are the two main dimensions of philosophy that every research paradigm is based on. Ontology has to do with what constitutes reality (Scotland, 2012) and a researcher conducting a study has to take an ontological position as to how reality is perceived. Epistemology on the other hand is concerned with the nature of knowledge and how it is created (Scotland, 2012). While the ontological concern is about how reality is perceived, epistemology is concerned about how that knowledge of reality comes into being and becomes known (Krauss, 2005). Differing ontological and epistemological position of researchers studying the same phenomena results in different research approaches (Scotland, 2012).

The first paradigm of research is positivism. It is a paradigm that is scientific in approach (Mertens, 2014) and aims at testing phenomenon through observations and experiments in order to predict results (O'leary, 2004). For positivists, observation and experiment is a means of obtaining true knowledge (Rahi, 2017). Positivist researchers believe that knowledge is not only objective but is also quantifiable (Antwi and Hamza, 2015). The ontological position of a positivist researcher is realism, which in essence, is a view that reality is independent of the researcher and can be objectively studied and measured through scientific methods, with no interference from the researcher (Hussain *et al.*, 2013). That is because positivist researchers believe that reality is driven by permanent laws of nature. The epistemological position of positivism is objectivism (Scotland, 2012). Humans experience the social world in an objective way that is reflective of an independent reality (Ron, 2004). Positivist researchers assume an impartial position when pursuing to discover an objective and absolute knowledge about reality (Scotland, 2012).

Interpretive paradigm, also known as the constructivist is another research paradigm. All social research is interpretive to constructivists because their desire to understand and interpret social reality is what guides the research. That is because interpretive researchers endeavour to understand meaning and beliefs of social phenomena by extracting human experiences in society (Hussain *et al.*, 2013). The ontology of interpretivism is relativism. Relativism means that reality is subjective since it varies from one person to another (Hussain *et al.*, 2013). Interpretivists believe that reality is mediated by human senses, hence it is subjective and not absolute (Scotland, 2012). The epistemological position of interpretivism is subjectivism (Hussain *et al.*, 2013). Knowledge and reality are created in

and out of interacting with humans and their world and is then developed and conveyed in a social context (Scotland, 2012).

The third paradigm is the transformative paradigm, also known as the critical paradigm. This paradigm came into existence during the 1980s and 1990s mainly because of dissatisfaction experienced with the existing research paradigms at the time in addressing issues faced by marginalised people and social injustice (Creswell and Creswell, 2017). The focus of critical researchers is essentially to emancipate people by transforming their contexts socially, politically and culturally (Alwan, 2007). The objective of critical researchers is to inspire change that inspire social institutions and structures of power to transform (Given, 2008). Often critical researchers assume a role of being transformative intellectuals who spearhead change to free people from their historical and social injustices (Crotty, 1998). Historical realism is the ontology of transformative paradigm because reality is not only considered to be historically tangible but also historically constructed. The epistemology of transformative paradigm is subjectivist. Knowledge is socially derived and the perception of people is viewed through their prejudice and values. (Crotty, 1998)

Pragmatism is the fourth research paradigm. The premise of this paradigm is the utility and efficiency in any given circumstance (Hussain *et al.*, 2013). Mackenzie and Knipe (2006) however expresses difficulty in considering pragmatism as a paradigm because of its non-alignment to any research philosophy. Hussain *et al.* (2013) is of the opinion that pragmatism may be considered a research approach that is neither concerned about whether reality is real or constructed socially i.e. it does not subscribe to one ontology and epistemology. The aim is to find what works for a given situation with no particular regard to the philosophical nature of reality. Proponents of pragmatism paradigm believe that true knowledge can be attained by employment of a mixed method approach (Johnson and Onwuegbuzie, 2004). The emphasis is not on the philosophy but on discovering a pragmatic solution to understanding the phenomena. Instead, what is essential is finding the best possible research techniques and procedure to solving the problem (Rahi, 2017). Hence, this paradigm uses a mixed method approach with no regard for the ontological and epistemological position (Hussain *et al.*, 2013). The following Table 3.1 is a summary of the objectives of the four different paradigms.

Table 3.1: Different paradigm functionalities

Research Paradigm/Knowledge Claim Positions	
Positivist	**Constructivism**
• Determination • Reductionism • Empirical observation and measurement • Theory verification	• Understanding • Multiple participant meanings • Social and historical construction • Theory generation
Advocacy/Participatory	**Pragmatism**
• Political • Empowerment issue-oriented • Collaborative • Change-oriented	• Consequences of actions • Problem-centered • Pluralistic • Real-world practice oriented

Source: (Rahi, 2017: p2)

The research philosophy of this study is consistent with the pragmatism paradigm. This paradigm is consistent with research aim of understanding how the construction of green buildings in South Africa embraces the adaptability. It was thus important to find a pragmatic way that would enable the discoverer of such knowledge on the ground rather than being loyal to one philosophical ideology over another. To this effect, this research utilised a mixed research methodology.

3.2 RESEARCH METHODOLOGY

Research methodology is a strategy or plan of action followed behind the choice of a particular method of collecting data and analysis (Scotland, 2012). It is a model of conducting research within a particular research ideology and is comprised of underlying belief systems that help to guide the researcher to choose one research methodology over another (Wahyuni, 2012). The concern of research methodology is "why, what, from where, when and how data is collected and analysed" (Scotland, 2012: p9). The choice of a particular research methodology is guided by the framework of the research paradigm (Antwi and Hamza, 2015). Every research methodology, whether the researcher is consciously aware or not, is founded on some theoretical orientation or paradigm (Tuli, 2010) and the nature of the research problem in the study determines which methodology to use (Noor, 2008). Thus, research methodology is directly dependent on the ontological and epistemological assumptions the researcher holds about the nature of reality (Hussain *et al.*, 2013).

3.2.1 Qualitative Research Methodology

As an umbrella term, qualitative research describes a cluster of research methods that use language data collected from interaction with the participants (Polkinghorne, 2005). Qualitative research is descriptive in nature because pictures and words are used to describe phenomenon, instead of numbers (Merriam, 2002). Furthermore, descriptive data such as interview reports, excerpts from video tapes or any other electronic communication is used as supportive evidence in the research, which adds to descriptive nature of the methodology (Merriam, 2002).

One of the distinguishing characteristics of qualitative researchers is their desire is to obtain a deeper understanding of the experiences of the people together with their attitudes (Bricki and Green, 2007). Meaning of phenomena is a social construct and knowledge is gained through interaction with the world, reality is not fixed but rather multi-dimensional, hence the interest of qualitative researchers is to discover how meaning is interpreted by individuals in a society (Merriam, 2002). The focus of qualitative research is to explore, examine, and describe phenomena in its natural environment (Orb *et al.*, 2001).

The process of qualitative research in inductive in nature because theories and concepts are built from the gathered data and information. Theories are formed from observations and intuitive understanding of the world through the eyes of society at a point in time (Merriam, 2002).

The domain of qualitative research is found in the social sciences and in all the applied fields that are derived from social sciences (Anderson, 2010). According to Rosenthal (2016) there are mainly two reasons for conducting qualitative research. The first one is that the researcher is interested in having an in-depth understanding of the 'why' behind the behaviour of people i.e. what drives peoples' attitudes and motivations behind their behaviour and actions. Qualitative research also aims to answer the 'what' and 'how' questions in society (Bricki and Green, 2007). The second reason for choosing qualitative research is when the researcher wants to have an in depth understanding of a specific subject topic from the perspective of the people on the ground with experiential knowledge (Rosenthal, 2016). Qualitative research methodology is underpinned by the principles of the interpretivism paradigm (Tuli, 2010).

3.2.2 Quantitative Research Methodology

The thrust of quantitative research is to explain phenomena by means of use of numerical data that is then analysed mathematically using statistical methods (Yilmaz, 2013). Quantitative research is scientific and empirical in nature (Atieno, 2009). Quantitative research methodology in wildly used in natural and social sciences such as physics, psychology and biology (Sukamolson, 2007).

The goal of quantitative research is to collect facts about human behaviour using predetermined response categories, which are then used to verify and elaborate theories (Castellan, 2010). The ultimate goal of quantitative research is to demonstrate relationships between different variables, establish facts, predict and control, as well as test hypotheses and theories (Castellan, 2010). Hence, the approach of quantitative research is confirmatory and deductive in nature (Atieno, 2009). Quantitative research identifies and is underpinned by the positivism research paradigm (Tuli, 2010). Quantitative researchers take a neutral detached position during a research process. Outside the predetermined responses, quantitative researchers do not attempt to understand the meaning of the phenomenon being studied through the eyes of the participants (Yilmaz, 2013). Table 3.2 below compares the different approaches between quantitative and qualitative research methodologies.

Table 3.2: Quantitative-Qualitative Methodology Comparison

Components of Research Approaches	Quantitative	Qualitative
Philosophical Assumptions	Positivist perspective, objective reality, researcher is independent of that which is researched	Postpositivist perspective, naturalistic, social, multiple & subjective reality where researcher interacts with that being researched
Method/Types of Research	Experimental, quasi-experimental, single subject and descriptive, comparative, correlational, ex post facto	Phenomenology, case study, ethnography, grounded theory, cultural studies
Purpose/Goal of Research	Generalizability, explanation, prediction	Understanding, insight, contextualization and interpretation
Questions or Hypothesis	Hypothesis is informed guess or prediction	Question is evolving, general and flexible
Those Being Researched	Randomly selected sample, proportionally representative of population	Usually a small number of non-representative cases
Those Conducting the Research	Etic (outsider's point of view); objective, neutral , detached and impartial	Emic (insider's point of view);personal involvement and partiality
Data	Questionnaires, surveys, tests, etc. in the form of numbers and statistics	Written documents from field work, interviews, pictures, observations, objects, etc.
Data Analysis	Deductive process, statistical procedures	Inductive process: codes, themes, patterns to theory

Source: (Castellan, 2010: p7)

3.2.3 Mixed Research Methodology

Mixed research methodology is a research that combines qualitative and quantitative research design in terms of approach, technique, concept and methods, into one single study (Antwi and Hamza, 2015). Traditionally, the two research methods subscribe to different paradigms or worldviews that are incongruent to each other, which is the reason for the conflict relationship between qualitative and quantitative research approaches (Foss and Ellefsen, 2002). Mixed research methodology is a response to the paradigm war debates over which methodology is superior between quantitative and qualitative research methodologies (Feilzer, 2010). For over a century there had been ardent disputes between proponents of quantitative and qualitative research paradigms (Johnson and Onwuegbuzie, 2004). At the heart of the difference between quantitative and qualitative research, is fundamentally, the difference in the ontological and epistemological paradigm outlooks (Atieno, 2009). Despite many disputes between the two traditional methods, the source of the difference in approach is philosophical rather than methodological (Krauss, 2005).

Mixing the two methodological approaches could mean, for instance, allowing the qualitative approach to take precedence whilst at the same time, using a quantitative methodology as a basis for preliminary inquiry in a qualitative work, or the other way round (Foss and Ellefsen, 2002). Onwuegbuzie and Leech (2005) views mixed research as a bridge that helps to close the divide between quantitative and qualitative research debates. Mixed research methodology is a logical and practical alternative that strives to move beyond the paradigm debate conflicts and is philosophically aligned to pragmatic paradigm (Johnson and Onwuegbuzie, 2004). Essentially, mixed method research studies, as explained by Sandelowski (2000: p 246), "are not mixtures of paradigms of inquiry *per se*, but rather paradigms are reflected in what techniques researchers choose to combine, and how and why they desire to combine them".

This research embraces a mixed method methodology because of its flexibility and practicality in allowing different methods of exploring and understanding the phenomena of adaptability of buildings from different perspectives. Because of the desire to gain a deep understanding and knowledge of the phenomena of building adaptability in green buildings in South Africa, qualitative research methodology is to take precedence over quantitative research methodology.

3.3 RESEARCH METHODOLOGY JUSTIFICATION

This research study utilised a mixed method methodology. This involved using a survey questionnaire together with semi-structured interviews as tools of collecting data. Mixed method methodology was deemed appropriate for this research because it allows a balanced view of the various perspectives of professionals who are involved in the design and construction of green buildings. The questionnaire was chosen as an instrument of collecting data because it enables a wider reach and therefore, would give a bigger sample size so that the findings can be generalisable over the population. Semi-structured interviews are appropriate for this study because they allow for in-depth conversations whilst still being controlled and guided. The in-depth conversations are essential in understanding how adaptability is incorporated in the design and construction of green buildings from the perspectives of the participants who are involved in such projects. The interviews are complementary to the questionnaire because they fill in the gaps and give a rich and insightful understanding of why and how building adaptability should be incorporated in the design and construction of green buildings.

Slaughter (2001) used a mixed method to investigate the design strategies that can be used to enhance building flexibility. The research investigated the nature of changes that are possible to occur on buildings including analysing specific strategies in terms of the design that can enhance building adaptability significantly. Data was collected from facility managers, architects, contractors, engineers

and construction managers using in-depth interviews, site visits, publications together with project documentation.

Shahbazi *et al.* (2017) also used a mixed method in the study to analyse the effective key factors in building adaptability of historical buildings. Collection of data was done through the use of questionnaires, interviews and observation.

3.4 DATA TRIANGULATION

Triangulation, in research terminology can be defined as the use of different research strategies, in terms of data collection sources, methods or theories in order to accurately represent reality (Denzin, 2017). Basically, it involves mixing two or more data sources, investigations or theories into one single research study (Thurmond, 2001).

Methodological triangulation in literature is also known as mixed method research (Creswell and Clark, 2017). Within methodological triangulation, two forms of triangulations can be found, namely: across method triangulation and within method triangulation (Bekhet and Zauszniewski, 2012). Denzin (2017) refers to the across method as the between methods triangulation. Casey and Murphy (2009) explain that across method triangulation involves combining quantitative and qualitative data collection methods to investigate a phenomenon whilst within method triangulation involves mixing two or more methods of collecting data that belong to the same research approach. For instance, this may mean collecting qualitative data by the use of interviews together with participant observations methods or collecting quantitative data by using questionnaires together with pre-existing database (Bekhet and Zauszniewski, 2012).

The merit of methodological triangulation is that it provides a more comprehensive data, increases validity of the results and serves as a confirmation of the research data (Halcomb and Andrew, 2005). In essence, triangulation can be viewed as a way of confirmation the accuracy of the data used in the research (Denzin, 2017). The primary purpose of triangulation is to confirm and complete data (Foss and Ellefsen, 2002). Confirmation of data has to do with seeking validation of the findings by examining and comparing data collected from different sources used in the research in order to ascertain if the findings converge (Casey and Murphy, 2009). The use of triangulation for confirmation helps to increase confidence and credibility of the findings (Halcomb and Andrew, 2005). Completeness of data has to do with seeking different perspectives from different data sources in order to gain insightful understanding of the phenomena (Casey and Murphy, 2009). The strength of triangulation is that it helps to overcome the weakness of one data collection method by compensating with the strength of another data source (Thurmond, 2001). Fossey *et al.* (2002) asserts that combining qualitative and quantitative methods to collect research data can be fruitful as long as the methods are used to complement each other in that while quantitative methods aim at giving a wide, general view of the surface, qualitative methods seek to give meaningful data that has depth and insight.

This research study utilises an across method triangulation. This involves employing a combined data collection method. A structured questionnaire together with semi-structured interviews are to be employed as means of collecting data. Questionnaires are a quantitative method of collecting data whereas semi-structured interviews are a qualitative method of collecting data. Using the two methods together will help to triangulate and confirm the data collected in order to increase the validity of the findings.

3.5 DATA COLLECTION METHODS AND TECHNIQUES

Collection of data is crucial in any research project because the quality of data contributes to a better understanding of the phenomenon being investigated (Bernard, 2017). It is imperative that sound judgement is applied to the manner in which data is gathered because there is no amount of data analysis that can undo the damage of data that is improperly collected (Tongco, 2007). Data can be collected either from primary sources or from secondary sources of data. Data collected from sources such as interviews or survey questionnaires is referred to as primary data whilst data from publications that is either publicly available or that is provided by research participants from their internal documentations, is termed as secondary data (Wahyuni, 2012).

3.5.1 Questionnaires

A questionnaire is a data collection method that involves respondents answering and completing questions in a written format (Marshall, 2005). It is a data collection method that is wildly used in surveys (Rowley, 2014) because of its cost effectiveness in collecting data from a large population (Marshall, 2005). According to Zohrabi (2013) there are three types of questionnaires, namely structured closed ended questionnaires, unstructured open ended questionnaires, and lastly, a combination of closed ended and open ended questionnaires. In close ended questionnaires, respondents answer questions by selecting answers from a predetermined list of answers and the numerical data collected is analysed quantitatively using statistic tools (Kendall, 2014). Gillham (2008) is of the opinion numerical data collected from closed ended questionnaires is easy to analyse, whilst open ended questionnaires result in richer and insightful qualitative data, that is however, difficult to analyse and compare.

The biggest advantage of questionnaires is that they enable data to be collected from a large sample of people, hence the sample sizes are larger, thereby leading to results that are more generalisable (Rowley, 2012). It is for this reason that questionnaires are used in quantitative research surveys where the objective of the researcher is to profile the population (Harris and Brown, 2010). Population does not necessarily refer to people only (Tongco, 2007) but can also mean a total number of items or cases being investigated by a researcher (Etikan *et al.*, 2016).

Various ways of administering questionnaires include sending them by post, emails, online or even face to face hand delivery (Rowley, 2014). According to Zohrabi (2013) questionnaires sent via post have a very low return rate compared to those sent via emails online because the latter makes it easier for the respondents to respond quicker. Questionnaires administered by hand, face-to-face may have a high return rate because the respondents are likely to respond immediately and clarity on ambiguous questions may be given by the researcher (Marshall, 2005).

A questionnaire composed predominantly of close-ended questions and a few open-ended questions is utilised in this research study to collect quantitative data. The questionnaire is used to collect data from a large pool of professionals who have knowledge and experience working on green buildings within the built environment of South Africa. The questionnaire was administered online to professionals who have expertise and experience in the design and construction of green buildings and who are in a position to incorporate adaptability principles in green buildings. Such professionals could be architects, designers and personnel from the Green Building Council of South Africa (GBCSA) who have expertise knowledge on the criteria of rating green buildings.

3.5.2 Interviews

Interviews are one of the methods of collecting qualitative data in research whereby a researcher is interested in getting first-hand information about the experiences of the interviewee in their our perspectives (Rowley, 2012). The main purpose of an interview is to gain knowledge and insight by

allowing the interviewees to share their perspective, expertise and experiences regarding a specific phenomenon the researcher is investigating (Boeije, 2009).

It is possible to conduct individual interviews with one person or with a group of people , which is also known as a focus group (Rowley, 2012). The nature of interviews can either be face-to-face or telephonically. Face-to-face interviews are most ideal for qualitative research although they tend to be time consuming and expensive compared to telephone interviews (Zohrabi, 2013). On the other hand, telephone interviews are quicker and effective provided there are no access barriers (Eaden *et al.*, 1999).

Interviews are generally a preferred method of collecting data compared to questionnaires for instance, as long as it is possible to identify key knowledgeable and informed people who are willing to share their experiences concerning a particular phenomenon (Rowley, 2014). Generally, the results derived from data collected through interviews is difficult to generalise or replicate because of the small sample sizes involved (Bryman, 2016).

According to Fossey *et al.* (2002) interviews can be classified according to the extent to which they are structured as well as their directness. Accordingly, structure has to do with the ease and flexibility that the interviewer has in asking questions to meet unique situations that spontaneously arise, while directness is concerned with extent of awareness by the interviewee of the purpose and nature of the research survey. On one end of the spectrum is the structured interviews. Zohrabi (2013) refers to structured interviews as structured closed-ended interviews. Structured interviews are similar to close ended questionnaires with the exception that instead of the respondents completing the questionnaire, they respond to the questions either telephonically or face-to-face (Williams, 2003). In a structured interview, the interviewer uses a set of predetermined questions and does not veer from them (Bhattacherjee, 2012). Generally, responses given in structured interviews are precise and short and the order of questions posed to all the respondents remains the same (Rowley, 2012). This is because all the questions delivered are predetermined beforehand in a fixed order of questioning (Zohrabi, 2013). The benefit that structured interviews has over questionnaires is that it affords an opportunity for respondents to seek clarity on questions that are unclear (Williams, 2003). The disadvantage of structured interviews is that they are too rigid and do not allow the respondents to freely express themselves, hence tend to be less engaging and boring to the interviewees (Zohrabi, 2013). Researchers are often drawn to structured interviews as a form of data collection because they result in an increased response rate compared to questionnaires (Rowley, 2012).

Unstructured interviews are at the other end of the spectrum. Unstructured interviews take a more conversational approach where the interviewer asks open ended questions and the interviewee, to a greater extent, takes the lead in narrating their story and experiences (Fossey *et al.*, 2002). The order of the questions asked is often prompted by how the interviewee responds and the conversation flow because the primary objective of the researcher is to encourage the interviewee to talk freely around the subject topic (Rowley, 2012). The interviewer asks questions as they emerge naturally from the flow of the conversation (Zohrabi, 2013). According to Rowley (2012) unstructured interviews require the researcher conducting the interview to be skilful and experienced and usually results in large interview transcripts that may be difficult to interpret and integrate.

In the middle of the spectrum lies the semi-structured interviews (Saunders, 2011). Semi-structured interviews are a cross between structured interviews and in-depth open interviews, and offer an opportunity for the researcher to gain knowledge by using an interview guide to ask predetermined questions while at the same time allowing enough flexibility for the interviewee to respond open and freely on the subject topic (Wahyuni, 2012). The advantage of using an interview guide is that the data

collected is able to be compared and contrasted later on (Fraenkel *et al.*, 2011). By far semi-structured interviews are the most preferred and common type of qualitative interviews (Rowley, 2012). This is because this interview approach is less rigid and more flexible without being too open (Zohrabi, 2013). The process of collecting data tends to be rather systematic and conversational (Rowley, 2012).

This research study made use of semi-structured interviews as one of the data collection techniques. The nature of this research required an in-depth understanding of how building adaptability is embraced as one of the ways of fostering sustainability of green buildings in South Africa, together with finding out the awareness levels of the professionals and stakeholders in the built environment of South Africa about the principle of adaptability in the design and construction of green buildings. Semi-structured interviews were appropriate for this because they allowed for a guided conversation in order to gain knowledge from the respondents' perspectives based on their experience on green buildings. The nature of interviews conducted were face-to-face interviews. Interviewees were professionals who had knowledge as well as practical experience of working on green building projects. These professionals were architects and engineers who were involved on the designing of green buildings, who were also in a position to incorporate and implement the principles of adaptability on their green building designs. Another group of people that were interviewed are green building/sustainability consultants who are responsible for advising on green building and sustainability issues as well the accreditation process of green buildings.

3.6 SAMPLING STRATEGY

A sample is a selected portion that represent the overall population (Etikan *et al.*, 2016). It is a process of choosing subjects to participate in a research study in order to provide relevant information based on their experience and expertise on the research problem (Oppong, 2013). Choosing who or what to incorporate in a sample is one of the critical decisions a researcher should make in a study (Kuper *et al.*, 2008). Collingridge and Gantt (2008) advise that there should be a clear rationale in the process of selecting participants in order to ensure that the sample is specific to the purpose of the research study. The adequacy of the sample size is important because if it is too small it might compromise the depth and breadth of the research whilst at the same time a sample that is too big might result in superficial volumes of data (Cleary *et al.*, 2014) Integral to all research designs is a component of sampling, hence it is a backbone of research integrity (Abrams, 2010).

Regardless of whether a quantitative or qualitative methodology is used in the study, the sampling methods are chosen with an intent to maximise efficiency and validity, even though such sampling must be compatible with the inherent aims and assumptions of the research methodology (Palinkas *et al.*, 2015). Underpinning quantitative and qualitative methodologies are different ideological assumptions that are influential to the different sampling aims and strategies for each methodology (Abrams, 2010).

The sampling strategy used on quantitative studies to collect data is random sampling (Byrne, 2001). Random sampling is also known as probability sampling. The underlying assumption in random sampling is that the population is normally distributed (Abrams, 2010) and that all the subjects in a population have an equal probability of being chosen into a representative sample (Etikan *et al.*, 2016). Probabilistic sampling strategy ensures that the research findings can be generalised over the population because there is no bias involved in the selection of the sample (Palinkas *et al.*, 2015). . Random sampling is a basic sampling strategy for quantitative data and can either be used as a sampling technique on its own or can be used as a building block for other complex sampling strategies (Meng, 2013). Stratified sampling is another strategy of sampling quantitative data (Díaz-García and

Cortez, 2008). The population is divided to various stratum of disjoint sub-populations, which are furthermore independently sampled (Sastry *et al.*, 2001).

In qualitative research studies the sampling strategies are not as clear cut as in quantitative methods (Palinkas *et al.*, 2015) and the sample is selected by means of non-probabilistic sampling strategies whereby subjects in a population do not have an equal probability of being chosen (Battaglia, 2008). Qualitative researchers recognise that some participants are better suited than others in providing insightful information and are especially interested in outliers because of their unique and extreme insights, hence random sampling strategies are ill suited for this type of research approach (Abrams, 2010). Qualitative studies rather use subjective judgement methods to select participants from a population to a sample (Etikan *et al.*, 2016). According to Battaglia (2008) non-probabilistic methods are cheaper and easier to implement, and are particularly preferable where the population is not clearly defined or in situations where the priority of the research study is not to draw inferences from the sample to the population.

There are three basis sampling strategies used in qualitative research studies namely: purposive/judgement sample, convenience sample and theoretical sample (Oppong, 2013). Haphazard sampling or accidental sampling are other terms used to refer to convenience sampling (Dörnyei, 2007). The subjects in a population are chosen because their proximity and ease of accessibility to the researcher, their availability and willingness to participate in the research study (Given, 2008). Convenience sampling is referred to as accidental because the subjects are chosen because of their convenience to the researcher (Etikan *et al.*, 2016). This sampling strategy is less costly in terms of time, effort and cost although it may result in poor quality data and less credible findings (Oppong, 2013).

In purposive sampling, subject chosen specifically because they fulfil a particular purpose the research study endeavours to achieve (Etikan *et al.*, 2016). Deliberate judgement is exercised in choosing subjects from a target population based on their knowledge and expertise on the subject matter under investigation together with their willingness and ability to articulately express their experiences (Bernard, 2017). It involves identifying and inviting subjects perceived by the researcher to have the best perspective and insight on the research problem (Abrams, 2010).

Theoretical sampling is formulated from information derived from emerging data from which explanatory theories are devised and a sample is chosen for the purpose of testing the configured theory (Oppong, 2013).

Ultimately, the sampling technique employed in a research project will depend of the purpose, type and nature of the research (Etikan *et al.*, 2016). Byrne (2001) emphasises the importance of understanding the purpose of the research study because it has a big influence on the choice of a sampling strategy that is appropriate for the study.

The size of a sample is a function of availability of resources, time constraints and research objectives (Oppong, 2013). Unlike in quantitative studies, the size of a sample in qualitative research should not be predetermined, rather the emphasis should be on data saturation (Kuper *et al.*, 2008). Data saturation in research occurs when all the research questions have been thoroughly answered in such a way that no relevant new concepts, information or themes is emerging from the enquiry and the data collection exercise stops (Trotter II, 2012). Cleary *et al.* (2014) refers to it as redundancy of information - a point at which gathering of data should stop because the wellspring of concepts has dried up and repetitive information is produced. Whilst qualitative data collection methods place emphasis on data saturation, quantitative methods usually have large sample sizes that enable

generalisation of the findings, hence the focus is sample size (Palinkas *et al.*, 2015). It is for this reason that sample sizes in qualitative studies tend to be smaller but "deeper" in terms of the quality of data produced, and sample sizes in quantitative studies are rather larger but however, "shallow" data collected (Baker *et al.*, 2012). What is important in qualitative research is that the sample size is not too large that it becomes difficult to analyse and extract rich data out of it whilst at the same time it is not too small that data saturation is not achieved (Onwuegbuzie and Leech, 2007).

A purposive sampling strategy was adopted for this research study. It is appropriate because it is consistent with the objectives of this investigation. The sample was composed of built environment professionals who are specifically involved in the design and accreditation of commercial green building projects which had been completed or were still under construction, in South Africa. The focus of this study is green commercial office buildings and that is what informed the selection of the participants.

3.7 RESEARCH QUALITY AND RIGOR

One of the greatest challenges researchers encounter during the process of conducting and reporting a research study is to striving to achieve the highest possible quality (Cope, 2014). Traditionally, quantitative and qualitative belong to different methodological school of thought hence there exists different criteria of critiquing each methodology (Cope, 2014). Quantitative research has a perspective of rigor and validity whilst the credibility and trustworthiness are the perspectives of qualitative research (Lincoln, 2007). Unlike quantitative research, which makes use of experimental and objective means, qualitative research has been criticised historically, for lack of scientific rigor (Cope, 2014). However, Anderson (2010) is of the opinion that when qualitative research is carried out properly it is rigorous, unbiased and reliable. Most of the invalidity allegations stem from lack of recognition of the purpose for which each methodology is suited for (Winter, 2000)

3.7.1 Research Validity

Quantitative research operates on the premise that data collection methods can be conceptualised as standardised, unbiased instruments or tools (Long and Johnson, 2000). Validity in quantitative terms, is a measure of how well a research instrument measures a phenomena being studied (Roberts *et al.*, 2006). Central to the concept of validity is, firstly, whether or not the instrument of measurement, such as a questionnaire, is accurate, and secondly, whether it is measuring what it is actually intended to measure (Winter, 2000).Validity measures the integrity and precision of the research findings that they accurately reflect the data collected (Noble and Smith, 2015).

The roots of validity criteria are found in the positivism paradigm of research (Golafshani, 2003). Validity can be further split into internal and external validity. Internal validity is concerned about whether the research findings are directly caused by the phenomena being investigated or any other influences (Winter, 2000). Internal validity seeks to address the reasons for the research findings and helps to eliminate any other unanticipated, unaccounted for, reasons for the research outcomes (Roberts *et al.*, 2006). External validity has to do with how much the research findings can be generalised and applied to a greater population (Winter, 2000). It is concerned with the extent to which there is confidence in the research outcomes such that they can be extended to other similar situations (Roberts *et al.*, 2006). It is possible for a study to have a very high internal validity but fail to have external validity at the same time (Winter, 2000).

Although qualitative researchers are not content with the validity term as expressed by quantitative researchers, they however, recognise the need to have some qualifying measure for their work (Winter, 2000). Consequently, alternative terms or concepts that are congruent with qualitative paradigm have been developed by qualitative researchers (Thomson, 2011). Internal validity as

defined quantitatively, is likened to credibility in qualitative terms (Thomas and Magilvy, 2011). Credibility is the truth of the research data in terms of the views expressed by participants, the interpretation and representation of those views by the researcher (Polit and Beck, 2008). Credibility is considered to have been achieved if other people in similar circumstances are able to immediately recognise and identify with the events and experiences of the participants in the study as described by the researcher (Cope, 2014).

Transferability in qualitative work is an equivalent of external validity in quantitative research (Thomas and Magilvy, 2011). Houghton *et al.* (2013) defines transferability as the ability of research findings to be to be transferred or applied to other settings. It is important for a researcher to provide a thorough description around the context of the study, the population studied, so as to enable the reader to determine the transferability of findings to other settings (McKee, 2004). This may also mean providing a rich and robust data presentations of the research findings, with quotations where appropriate, as a way of enhancing transferability (Graneheim and Lundman, 2004).

3.7.2 Research Reliability

Reliability in quantitative terms, is perceived as the accuracy of a measuring tool in giving out consistent results every time when used under similar conditions (Heale and Twycross, 2015). Whittemore *et al.* (2001) defines reliability in research as the stability of findings, whereas Leung (2015) refers to it as the replicability of the processes involved as well as the findings. The concern of reliability is whether or not a research study can be repeated and still derive similar results (Lee and Baskerville, 2003).

Traditionally, validity and reliability are concepts derived from positivist tradition and hence qualitative researchers view them differently because they consider these term inadequate and inapplicable to qualitative research (Golafshani, 2003). In qualitative research, reliability is tested by examining the trustworthiness of the research (Golafshani, 2003). To demonstrate reliability, a qualitative researcher has to show that there was no carelessness in the recording and analysis of data, by way of misrepresenting or inventing data (Carcary, 2009). In qualitative terms, reliability is likened to dependability (Graneheim and Lundman, 2004; Tobin and Begley, 2004; Rolfe, 2006; Shah and Corley, 2006). Consistency of data over similar conditions is referred to as dependability (Tobin and Begley, 2004; Polit and Beck, 2008). Dependability is achieved when another researcher can review the research and be able to agree with the decision trails taken at every stage of the research (Koch, 2006). This requires a detail report of the processes and decision made within the research study in order to ensure that a future researcher can repeat the research and possibly achieve similar outcomes (Shenton, 2004). An audit trail is a means of establishing trustworthiness of study as well as quality assurance (Akkerman *et al.*, 2008). The purpose of an audit trail is to enable another reader to audit the events, decisions and actions taken by the researcher during the research investigation (Koch, 2006) in order to provide a rationale behind the methodological and interpretative decisions taken by the researcher (Houghton *et al.*, 2013).

The following table gives a distinction between validity and reliability between the quantitative and qualitative dimensions:

Table 3.3: Validity & Reliability

Quantitative research terminology & application to qualitative research	**Alternative terminology associated with credibility of qualitative research**
Validity The precision in which the findings accurately reflect the data.	**Truth value** Recognises that multiple realities exist; the researchers' outline personal experiences and viewpoints that may have resulted in methodological bias; clearly and accurately presents participants' perspectives.
Reliability The consistency of the analytical procedures, including accounting for personal and research method biases that may have influenced the findings.	**Consistency** Relates to the 'trustworthiness' by which the methods have been undertaken and is dependent on the researcher maintaining a 'decision-trail'; i.e. the researcher's decisions are clear and transparent. Ultimately an independent researcher should be able arrive at similar or comparable findings. *Neutrality (or confirmability)* Achieved when truth value, consistency and applicability have been addressed. Centres on acknowledging the complexity of prolonged engagement with participants and that the methods undertaken and findings are intrinsically linked to the researchers' philosophical position, experiences and perspectives. These should be accounted for and differentiated from participants' accounts.
Generalisability The transferability of the findings to other settings and applicability in other contexts.	**Applicability** Consideration is given to whether findings can be applied to other contexts, settings or groups.

Source: (Noble and Smith, 2015: p2)

3.8 UNIT OF ANALYSIS

Accoding to Yin (2006) unit of analysis is an implicit, if not an explicit feature that hold every research study together. The importance of setting a unit of analysis is that it allows the researcher to determine the manner in which data is to be presented and analysed (Patton, 2002). The essence of this research is to find out how green buildings respond to change of use over time, through their design and subsequent construction. Thus, the unit of analysis of this study is adaptable green buildings.

3.9 DATA ANALYSIS FRAMEWORK

Since the research utilized a mixed method approach, different methods of analysing data were employed.

3.9.1 Quantitative Data Analysis

To analyse quantitative data Punch (2013) advises that the numerical data produced from the research is best analysed by use of statistical tools. Depending on the distribution of the data collected, the analysis can either use parametric statistics such as standard deviation, mean and infererential statistics or non-parametric statistics such as ranges, frequencies and percentages. Parametric statistics are relevent when the data is normally distributed while non-parametric statistics are useful when the data is not normally distributed. In this research, non-parametric statistics were used.

3.9.2 Qualitative Data Analysis

To analyse qualitative data, this research used thematic data analysis. Punch (2013) provides a framework for analysing qualitative data. The framework involves three steps of data summarisation and editing, categorising the collected data into themes and lastly,searching similarities and differences in the data.

Braun and Clarke (2006) explain that themes are common threads of information which are frequent across discusions with various interviewees, that are important in describing phenomenon associated with research questions. As such, a point raised by interview respondents becomes a theme when it is repeated by most of them.

The recorded data collected from the interviews are transcribed and then analysed by using thematic topics. This involved the researcher studying and familiarising with the data in order to understand the content. This first step was important because it made it easy to identify and develop common themes that were emerging from the data. This involved sifting the data to find similaries and differences and grouping them accordingly. The last part was defining and naming the themes. Findings from the interviews were presented descriptively in line with objectives of the study stated in Chapter one.

3.10 RESEARCH ETHICS CONSIDERATION

According to Bhattacherjee (2012) there are potential challenges regarding research ethics and bias that every researcher must be wary of. As such, confidentiality is one of the ethical issues that must be guarded closely, especially when conducting qualitative research because respondents may be uncomfortable and reluctant to provide specific information on some questions if their confidentially is not assured.

For that reason, anonymity was given to all the interview respondents on this research study. Their personal details together with the companies they worked for was not revealed. In the analysis of the data the interviewees were named as Interviewee A, Interviewee B, Interviewee C, Interviewee D, Interviewee E, Interviewee F, Interviewee G, Interviewee H and Interviewee I. The naming of the participants was based on the chronological order in which the interviews took place i.e. Interviewee A was the first interview and Interviewee I was the last interview conducted. Interviewee A, Interviewee B, Interviewee G and Interviewee H were architects. Interviewee E was a Structural Engineer whilst Interviewee C, Interviewee D, Interviewee F and Interviewee I were green building and sustainability consultants.

Consent to conduct interviews are sought out before the interviews took place and all the interviewees were given consent forms to sign prior to the start of the interviews. The consent form outlined that the objectives of the research and stated that participation was voluntary and that participants were at liberty to withdraw their participation at any time. The consent form also stated that all effort would be made to maintain confidentiality of the participants and that all the data collected would be used for the purpose of this research only.

The interview participants were encouraged to read and understand the consent form prior to signing it. In two cases the interviewees requested to have the consent form emailed to them prior to the day of the interview so they can read and understand it well before the interview.

3.11 DATA COLLECTION PROCESS

This study utilises a mixed method of research therefore quantitative and qualitative data was collected. Data was collected from professionals in the Building and Construction industry as well as professionals who are members of the GBCSA who are mostly involved in the accreditation of green buildings.

3.11.1 Quantitative Data Collection Process

The instrument of collecting quantitative data was through a questionnaire. In order to get optimum response from the target population it was important to sought an audience from the respective professional bodies that govern the different targeted professions. The three bodies that were approached were the Green Building Council of South Africa (GBCSA), the South African Council of the Architectural Profession (SACAP) and Engineering Council of South Africa (ECSA). The three professional bodies were chosen to be appropriate for the study because they house the target population for this research. To that effect, the researcher sort to seek permission to have access and permission to have members of the bodies participate on the survey by sending the questionnaires to the respective councils so that the questionnaire can be distributed to all the members who are affiliated with the respective bodies.

Unfortunately, permission was not granted by all the professional bodies because they said they are no longer disseminating questionnaires from people who are not members. Thus, the method of collecting data that was followed was to make contact with different organisations individually and have them answer the questionnaire. Another way was to utilise contacts that were already known to the researcher to collect data.

3.11.2 Qualitative Data Collection Process

The same method of gaining access to different governing professional bodies to collect data was followed. After unsuccessful attempts the researcher compiled a list of companies from the GBCSA website that have been involved in the design and construction of green buildings and then interviews were sort out with those organisations, in order to understand how building adaptability was

incorporated in the design and construction of those buildings. Although it was not easy securing interviews with different companies, a total of nine interviews were conducted. Of the nine interviews, four of them were architects, four were professionals from GBCSA and one was an engineer. Three of the companies that were interviewed were not sure about the topic so they requested to be sent interview sample questions prior to the day of the interview so that they can determine, within the organisation, the best person to assign to the interview, based on their experience on the projects related to the subject topic. All the interviews were in Gauteng although the project discussed were across South Africa. All the interviews were recorded and transcribed.

3.12 CONCLUSION

The purpose of this chapter was to layout a practical roadmap of how the research was conducted within a paradigm framework of thinking guided by the research question. As such the research methodology was defined and justified. A mixed method study was perceived to the best way of drawing out the kind of information needed to understand how adaptability in buildings has been incorporated in the construction of green buildings. Through in-depth discussions in the form of semi-structured interviews, rich data would be drawn out while at the same time the use of a questionnaire would allow for a larger sample size that would enable the findings to be generalisable.

CHAPTER 4: RESEARCH DATA PRESENTATION AND ANALYSIS

4.1 CHAPTER OVERVIEW

In this chapter, the results of the data collected using the instrument of a questionnaire and semi structured interviews, are presented and analysed. The details of how the data was collected, the challenges and successes that were encountered are also discussed on this chapter.

4.2 TESTING DISTRIBUTION OF THE DATA

Prior to data analysis, it is important to conduct a test that seeks to find out if the data collected is distributed normally or not. The purpose of the test to gain knowledge as to which parameters to use in analysing data, between parametric statistics or non-parametric statistics. Parametric statistics (such as mean, standard deviation, mean, skewness and kurtosis and inferential statistics such as regression, t-tests, Pearson correlation analysis) are used only if data has normal distribution and non-parametric statistics such as frequencies, percentages and ranges are relevant for use when the is not normally distributed.

Shapiro-Wilk test was used to test the data for normality (for only non-redundant variables). Shapiro-Wilk test was preferred ahead of Kolmogorov-Smirnova as it is stable for sample sizes that are less than 60 (Yin, 2006). The following hypothesis was used to test if data gathered for the study was normally distributed:

H_0: Data gathered for the study is normally distributed

H_1: Data gathered for the study is NOT normally distributed

It is observed that the p-values of all the attributes shown in Table 4.1 below are less than 0.01 ($p < 0.01$). This means that the corresponding H_0 hypothesis is rejected and it concluded that the data is not normally distributed. Therefore, non-parametric statistics such as frequencies, percentages and ranges are relevant and will be used for data analysis on this study.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	p-values	Statistic	df	Sig.
Qn4	.250	43	.000	.879	43	.000
Qn5	.290	43	.000	.808	43	.000
Qn6	.240	43	.000	.868	43	.000
Qn8	.246	43	.000	.860	43	.000
Qn9	.140	43	.035	.896	43	.001
Qn11	.223	43	.000	.827	43	.000
Qn12	.285	43	.000	.789	43	.000
Qn13	.290	43	.000	.748	43	.000
Qn14	.321	43	.000	.733	43	.000
Qn16	.251	43	.000	.886	43	.000
Qn17	.308	43	.000	.679	43	.000
Qn18	.301	43	.000	.814	43	.000
Qn19	.287	43	.000	.768	43	.000
Qn20	.233	43	.000	.887	43	.001
Qn21	.334	43	.000	.758	43	.000
Qn22	.265	43	.000	.826	43	.000
Qn23	.161	43	.007	.907	43	.002
Qn24	.214	43	.000	.887	43	.001
Qn25	.312	43	.000	.813	43	.000

Table 4.1: Test for the distribution of data

4.3 SURVEY RESPONSE RATE

There were eighty-nine survey questionnaires that were distributed online to various professionals within the built environment. The survey was primarily targeted to architects, engineers and people who are affiliated with the Green Building Council of South Africa (GBCSA), who are involved in the process of accreditation of green buildings, such as green building consultants, sustainability and environmental consultants. The reason these professionals were identified as the target population was because they are directly involved in the design and rating of green buildings, respectively, and thus, have a major influence on the outcome because of their unique position that affords them an opportunity to influence the design in terms of adaptability. Of the eighty-nine questionnaires sent out, forty-eight were completed and returned. Three of the responses from the forty-eight were from Quantity Surveyors. These were rejected because they were outside the target population. Quantity Surveyors are neither responsible for the design of building structures nor are they directly involved in the design of them. Furthermore, Quantity Surveyors are not involved in the accreditation of green buildings, and hence they were not in a position to provide credible responses. Given the accepted forty-five responses, the response rate was 50.56%.

4.4 BACKGROUND INFORMATION OF PARTICIPANTS

Participants in the research study came from diverse back grounds with varying levels of expertise and work experience.

4.4.1 Survey Questionnaire

There were 20 architects who responded to the survey questionnaire, which translates to 44.44%. There was an equal number of architects and engineers who responded to the survey questionnaire. Thus 20 engineers responded, also providing a 44.44% response rate. Only five people who are green building consultants participated in the questionnaire survey, which is 11.11% of the total number of the sample size

4.4.2 Semi-structured Interviews

There was a total of nine interviews conducted altogether. All the interviews were recorded and transcribed. Of the nine interviews, four were architects, another four were green building consultants and one was an engineer. All the interviewees were people who have substantial experience working on green buildings. The purpose of interviewing architects and engineers was to gain understanding of whether or not during the design of green building, the concept of building adaptability is considered and factored into the design. Green building consultants were interviewed in order to discover if building adaptability is part of the criteria considered in the rating process of green buildings. All the interviews took place in Gauteng, between Johannesburg and Pretoria, although the green projects under which the discussions centred on were all over South Africa, especially in Cape Town.

4.4.3 Industry Experience of Respondents

Most of the respondents had 11-15 years working experience in their profession. Three architects had experience that is above 20 years as shown on the table below:

No of Years' Experience	No of Architects	%	No of Engineers	%	No of Green Consultants	%	Total No
Above 20 years	3	15%	-	0%	-	0%	3
16-20 years	1	5%	3	15%	-	0%	4
11-15 years	7	35%	10	50%	-	0%	17
5-10 years	6	30%	5	25%	4	80%	15
Less than 5 years	3	15%	2	10%	1	20%	6
Total	**20**	**100%**	**20**	**100%**	**5**	**100%**	**45**

Table 4.2: Industry experience of respondents

4.5 FAMILIARITY WITH THE CONCEPT OF BUILDING ADAPTABILITY

Approximately a third of the respondents (31.2%) from the questionnaire survey indicated that they are very familiar with the concept of building adaptability, while the rest of them had little to no

familiarity. The majority of the respondents (53.3%) as shown on Figure 4.1 were somewhat familiar with the concept. This could mean that they had somehow either come across the concept or heard about it even though they may not have had extensive knowledge or personal experience of projects involving building adaptability. Only two respondents were extremely familiar with the adaptability concept, whilst one had never heard of it and so was not familiar at all. The following figure illustrates the degree of familiarity of building adaptability by built environment professionals:

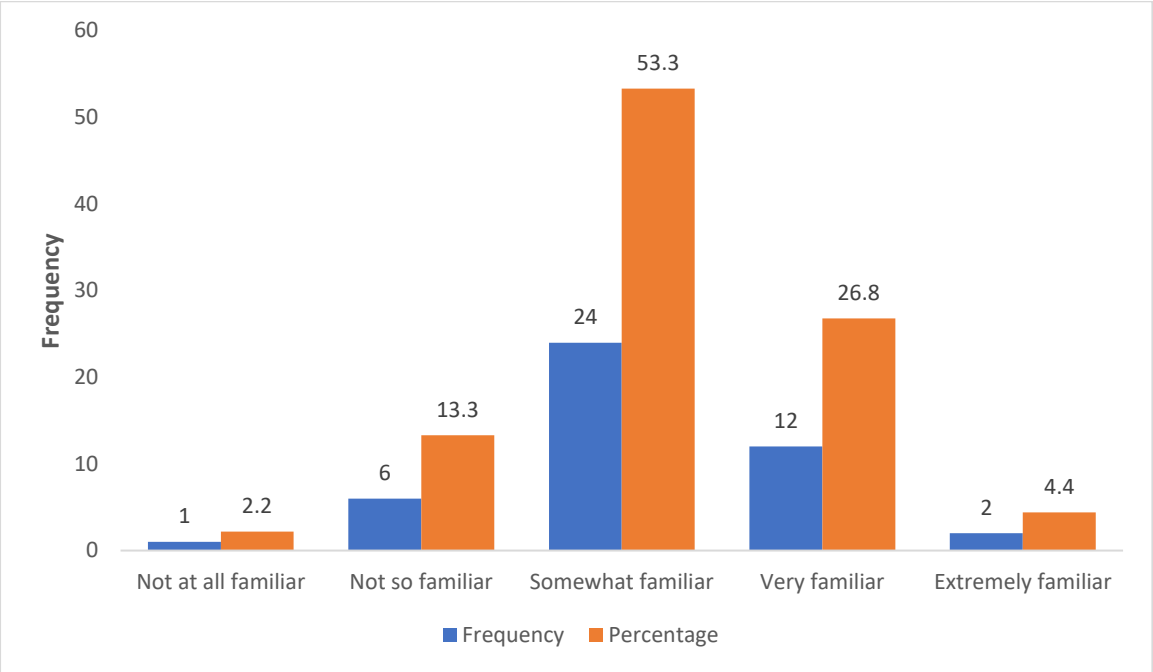


Figure 4.1: Amount of familiarity with the concept of adaptability

The findings of the questionnaire survey were consistent with the interview findings. From all the professionals that were interviewed, only architects displayed a clear level of familiarity with the concept of building adaptability. The rest of the interviewees were not very clear about what building adaptability is. That was shown by them requesting the researcher to provide a definition of building adaptability or an example of it at the beginning of the interviews. However, with the progression of the interviews, it would become clear that even though the terminology of building adaptability is unfamiliar to them, the appreciation of the concept was there. Some of them knew it better as 'future proofing' whilst others identified it with the concept of design for dissemble. For instance, Interviewee E declared at the start of the interview no experience of working on a project that involved building adaptability but later on revealed knowledge of experience in designing for future loads of a building structure.

4.6 LEVEL OF AWARENESS OF BUILDING ADAPTABILITY

It was important for the researcher to understand how much awareness there is around the subject of building adaptability, and where that awareness came from so that knowledge gaps could be identified for future developments.

4.6.1 Level of Awareness of Building Adaptability by Professionals

If building adaptability is as important in the long-term sustainability of green buildings as was revealed in the literature review as well as in the data collected from interviews and questionnaires,

the next step was to understand how much awareness there is around the subject in the built environment of South Africa. This is important because if there is no knowledge and awareness it will remain on the periphery of developments and the benefits it brings to green buildings would not be experienced and realised. More awareness is needed in order to cut the circle of blame as described by Pinder *et al.* (2011) where all the stakeholders are involved in the virtuous circle of blaming each other. Knowledge must start from somewhere and then spread to other places.

Interviewees were asked how much awareness was there about building adaptability in South Africa. Most of the interviewees revealed that because of the nature of business of commercial offices that requires the needs of different tenants to be accommodated, there was awareness around the subject although it is not much. Interview F said adaptability is not a topical subject presently mostly because *"people are focussing on the low hanging fruits like energy reduction and water reduction".* Even though the Interviewee acknowledged that building adaptability "*is a good and sustainable idea"* she expressed uncertainty of the practicality of the concept in the South African context.

Interviewee D mentioned that *"in principle professionals are aware of the concept of adaptability"* whereas Interviewee B and Interviewee I added that many of the professionals in the industry are aware of the concept however, choose to ignore it.

"…often, it's not that people are not aware, they are aware. It's just that, because it's something new, there is a bit of resistance of, you know, getting on board". **Interviewee I**

Interviewee E explained that the reason for the resistance is because designing for adaptability takes designers out of their comfort zone, out of their normal, traditional way of designing and constructing buildings. The Interviewee acknowledged that designing for adaptability brings with it a lot of complexities that many engineers would not normally want to get it into, given a choice.

4.6.2 Sources of knowledge of building adaptability

Findings from the questionnaire survey and interviews revealed that most of the respondents acquired the knowledge of building adaptability from work than from anywhere else. As illustrated on Figure 4.2 below, just more than half of respondents on the survey questionnaire (51.1%), learnt of building adaptability from work, whilst 28.9% said that they learnt it from university. Only two respondents indicated that they had never heard of the concept before.

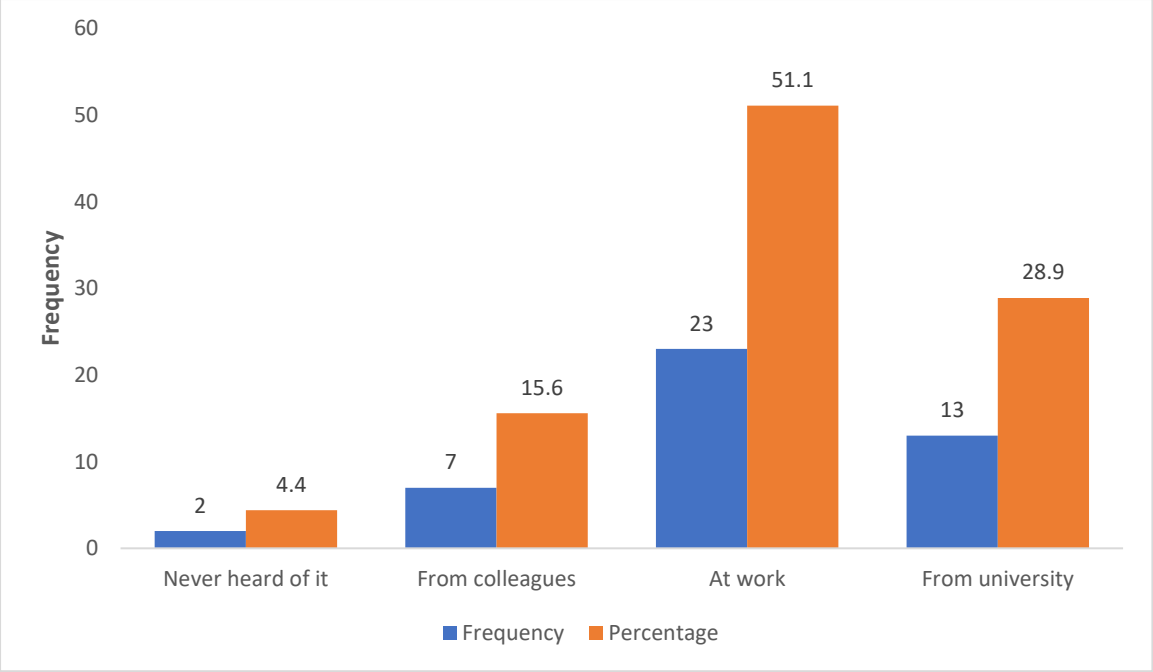


Fig 4.2: Knowledge sources of building adaptability

The survey findings concur with what was revealed from the interviews. Most of the interviewees, apart from for two architects, said that they became aware of building adaptability in their line of work as they were working on different projects. Interviewee E explained that most of the awareness of building adaptability is project driven because;

" ….. *if you have never worked on a project where the architect and the client say, 'we are going to design for adaptability', then it is very unlikely that anybody would have an in-depth awareness of it*". **Interviewee E**

Interviewee H explained that the very nature of working on commercial office buildings requires one to understand the client's needs in terms of accommodating different tenants in a building, which places a demand on the building to be adaptable to different needs of various tenants. It is working on such projects that has brought awareness to the knowledge of building adaptability to the Interviewee. Similar sentiments were expressed by Interviewee G who said that working with different developers and trying to meet their demands, the need for adaptable spaces has become a commercial reality, especially in the office markets where the building is expected to accommodate the needs of different tenants. Interviewee H explained that knowledge on building adaptability is acquired *"more when you start working in the industry. You learn more about the client's needs and how that needs to be accommodated".*

However, two of the interviewees, who are architects, said that they learnt about building adaptability from university on sustainability modules that are embedded in the studies of architecture. Interviewee A indicated that although it was not directly taught as a module, it was however studied briefly under sustainability courses.

"*… it was never addressed directly, I think again, but there was also, like something, kind of, like unspoken, that the more adaptable and flexible your building is, the better your building actually is*". **Interviewee A**

Interviewee E, who is a structural engineer, recalled first coming across building adaptability during the period of studying architecture before changing the study programme to engineering. The Interviewee mentioned that building adaptability was taught briefly on the sustainability modules in architecture but was not taught at all in the engineering modules. Two of the interviewees indicated that they had neither heard of building adaptability nor encountered it yet on any of the projects they had been involved in so far.

4.6.3 Awareness of Projects Involving Building Adaptability

One way of acquiring awareness of building adaptability is by way of exposure to projects that incorporated the concept, as was explained by Interview E that most of the knowledge is project driven. Respondents were requested to state if they had knowledge of any project that involved building adaptability, whether they had been personally involved on that project or not. Figure 4.3 below shows the results of the questionnaire survey on the question of awareness of any building projects involving adaptability on their design and construction:

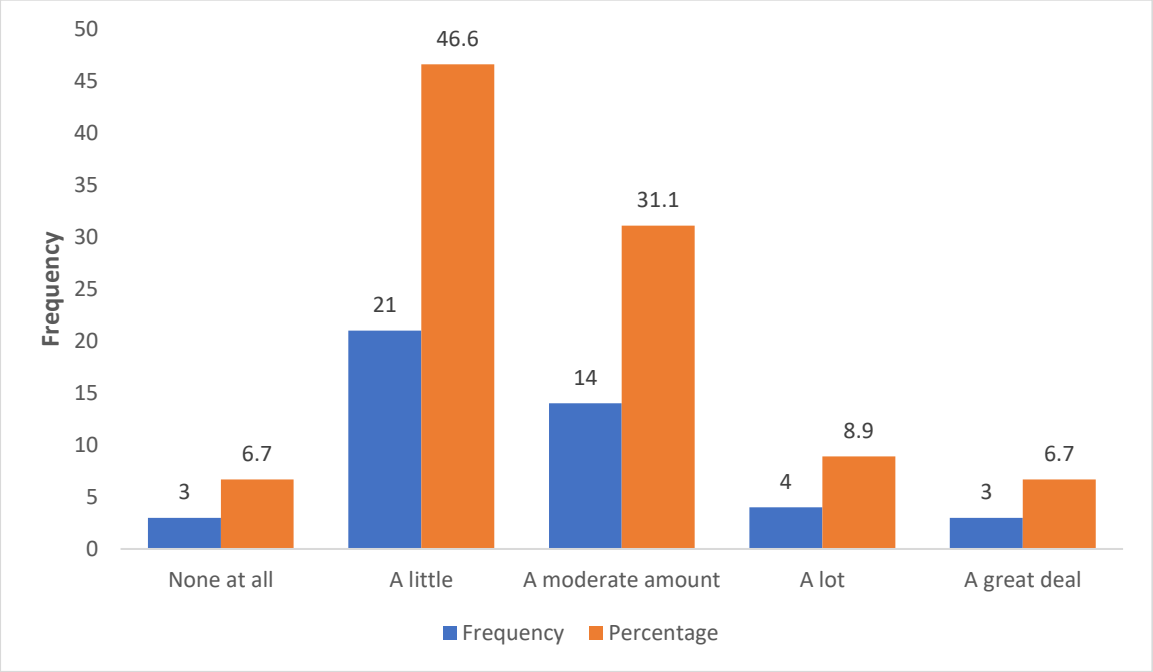


Fig 4.3: Knowledge of building projects involving adaptability

From the Figure 4.3 above, three of the respondents had no knowledge at all of any project that incorporated the concept of building adaptability whilst on the other hand only three of the respondents had a great of deal knowledge of such projects. The majority of the respondents had little to moderate knowledge of adaptable building projects.

Interviewee E, even though not having had personal experience working on an adaptable building, cited an example of an on-going adaptable project that the company was currently involved on, where the facility was being designed for a specific event that will occur in the future but with the ability to be converted to a different use post the occurrence of the event. That meant that the structure was designed with the ability to dismantle.

Interviewee D referred to a prestigious building in Sandton that achieved a five-star design rating accreditation. The building was designed to have flexible interiors for tenant fitouts. Interviewee H cited an example of a project in Rosebank that was still under construction at the time of the interview,

but had been design accredited because the design of the structure had been completed. The project was designed for adaptability with the use of modular patterns that enables the interior spaces to be easily changeable. Interviewee A mentioned a project he had once been involved on that was constructed to be an office but was later on converted into a residential apartment.

4.6.4 Ways of Raising Awareness of Building Adaptability

In order to gain more insights, all respondents were requested provide suggestions on what could be done to raise awareness of building adaptability. Various ways of promoting building adaptability and raising its awareness within the built environment of South Africa were given by respondents.

4.6.4.1 Incorporating Building Adaptability in Tertiary Education Curriculum

The common answer that was pervasive across the interviews and questionnaire survey was that building adaptability should be part of a curriculum offered at universities and other tertiary institutions. More than half of the participants from questionnaire survey held the same view that more should be done at tertiary institutions to educate students on sustainability and building adaptability issues.

Interviewee D acknowledged that most built environment departments at tertiary institutions are already teaching on sustainability courses substantively, but suggested that they probably need to extend their curriculum a little to include issues of building adaptability, since they are linked to the sustainability of the built environment. Interviewee E echoed the same sentiments that education on adaptability should start at universities because the institutions already have "*a captive audience*" that is there to learn. For this reason, it is easy to pass on the knowledge to the students, who then would eventually take it to the workplace so that they can advocate for it and influence the design and construction of buildings.

The importance of built environment professionals being knowledgeable on building adaptability, as much as they are on sustainability and green buildings was emphasised by many respondents because of the influential position professionals have on building developments in the industry. An informed and knowledgeable professional project team is able to provide innovative solutions to a client or developer. Interviewee I acknowledged that;

"… the client's needs always come first, but what I have seen happening now is that because the project team is aware of designing for flexibility or adaptability, they are able to encourage the client to relook their design and think of designing with flexibility and future proofing in mind"

From the interviews it was also established that building adaptability is taught a little in architecture at university. This was deduced from the fact that all the architects who were interviewed admitted that they did touch on adaptability at university, although it was not in depth and detailed.

4.6.4.2 Incorporating Building Adaptability in the Rating Criteria of Green Buildings

One important way of raising awareness that most respondents alluded to was that GBCSA should provide clear incentives for incorporating building adaptability in the design and construction of green buildings so that building designers are encouraged to incorporate it in their work. Interviewee D and Interviewee I suggested that GBCSA does not necessarily have to develop a new standalone tool for building adaptability, but could extend existing rating tools to have specific and clear requirements for building adaptability so that they are credits earned for it. At the present moment there is no incentive

to design for adaptability to the fullest because most of efforts will not be credited for in terms of green star points.

4.6.4.3 Incorporating Building Adaptability into CPD Courses Provided by GBCSA

Professional are expected to keep learning as they work so that they stay abreast with new technologies and innovations in the industry. It is for this reason that some respondents suggested that another way GBCSA could do to promote building adaptability and raise awareness simultaneously is to include it as part of their Continual Professional Development (CPD) courses that they provide to their members who are affiliated to the organisation. Through this approach the professionals who are already practising in the industry who did not have an opportunity to learn the concept at tertiary institutions would learn and acquire skills on how to implement building adaptability on their building projects.

4.6.4.4 Creating a Building Adaptability Flagship Project

According to Interviewee E, *"…awareness is created by actually implementing something"*. The interviewee said that there would be much more awareness if there was an award-winning project that could show case building adaptability and its benefits so that everyone would learn from it. The same point was also expressed by Interviewee F, that the built environment industry of South Africa needs a few pilot projects that can be used as a 'case studies' on building adaptability in order to assess how it would work in the South African environment.

4.6.4.5 Enforcement Through By-laws and Regulations

Research also identified that enforcing building adaptability through building by-laws could be another way of increasing awareness. That way compliance would become mandatory in all construction work. That would be an ideal solution that would enable all buildings to be built with adaptability. However, Interviewee A expressed concern at the practicality of enforcing such building regulation because of the fact that building adaptability is not quantifiable and that there are no set standard parameters that define how much adaptability could be deemed acceptable in any building construction.

4.6.4.6 Publications and Academic Journals

Some respondents suggested writing scholarly journals about building adaptability as another way of raising awareness. Although there is a lot of international journal articles written on the subject of building adaptability,

"…there is not a lot of South African contextualised content that looks at adaptability within the South African context. The publications are there, but they are not within our context" **Interviewee I**

Interviewee F suggested having conferences on building adaptability regularly and inviting international speakers who are knowledgeable on the subject to speak on the conferences, as another way of increasing awareness.

4.6.4.7 Providing Incentives to Developers

Ensuring that there is an incentive for developers to develop adaptive buildings was another suggestion by respondents of increasing building adaptability. Incentives would attract attention of

developers and investors towards adaptability. Interviewee C explained that anything that has an ability to increase the profit margins or reduce the expenses of developers will get their attention because they are profit driven. Something like a tax incentive such as a tax rebate given to developers who build developments that are adaptable to a change of use could be one way of building excitement and awareness around building adaptability that was suggested by respondents.

4.7 INCORPORATION OF BUILDING ADAPTABILITY IN THE DESIGN AND CONSTRUCTION OF GREEN BUILDING

It was important to ascertain how much building adaptability is incorporated in the design of green buildings as well as how that is done by designers.

4.7.1 The Degree to Which Building Adaptability is Incorporated in the Design of Green Buildings

The first step was to understand how much building adaptability is incorporated in the design and construction of green buildings. The idea was to find out if building adaptability is something that is considered at all in the design of green buildings. It was important to begin with an understanding of how much experience respondents had in working on adaptable green buildings.

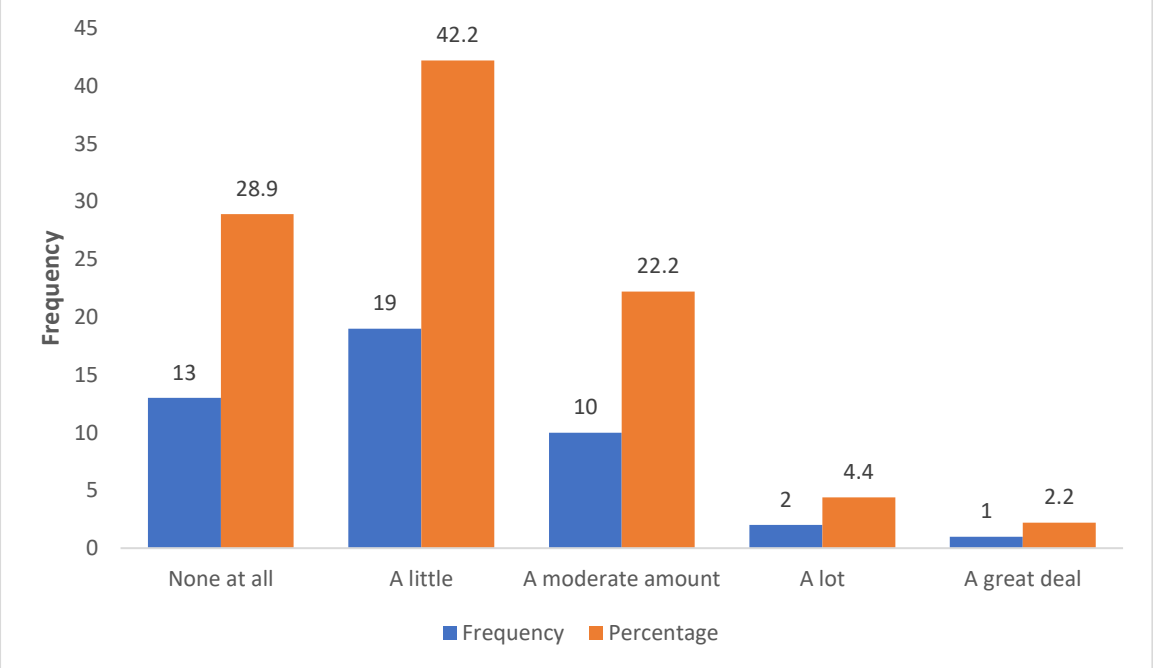


Fig 4.4: Experience working on adaptable green buildings

The findings of the questionnaire survey above shows that the majority of the respondents did not have a lot of experience working on green buildings that have adaptability elements incorporated on the design. A total of 28.9% of the respondents had no experience at all working on adaptable buildings, whilst only three of the respondents had had a significant experience of working on adaptable green buildings. The findings illustrate that most professionals have little exposure working on green buildings with adaptability.

From the interviews, all the interviewees seven of the nine interviewees had worked on green buildings with adaptability. Davison *et al.* (2006) reports that very few of the existing modern buildings

are designed intentionally for adaptability. Possibly, one of the reasons for lack of experience on adaptable green buildings is that often the majority of the buildings are designed with rigidity, for single use as suggested by Unzurrunzaga and Branchi (2013). Interviewee D had the following to say concerning building adaptability and exposure by professionals in the built environment of South Africa;

"… Well, building adaptability is relatively a new strategy of designing, I think. I mean, if we consider how long green buildings have been on the market, how much green buildings are in the market in comparison with adaptability, I would say that adaptability probably is a newer term than sustainable buildings, specifically for the South African market". **Interviewee D**

After determining the degree of exposure of respondents in working on adaptable green buildings, the next step was to find out how much adaptability had been actually incorporated by respondents on the green buildings for which they had an experience of designing for. Table 4.3 below shows the research findings from the questionnaire survey.

	Architects		**Engineers**		**Total**	
	Frequency	%	Frequency	%	Frequency	%
More than 20%	3	15%	6	30%	9	22.5%
10-20%	6	30%	6	30%	12	30%
Less than 10%	5	25%	1	5%	6	15%
None	6	30%	7	35%	13	32.5%
	20	**100%**	**20**	**100%**	**40**	**100.00%**

Table 4.3: Amount of building adaptability incorporated on green buildings

Overall, 22.5% of the respondents had incorporated more than 20% adaptability in the green building designs, whilst 32,5% of the respondents had not incorporated building adaptability at all on the design of green buildings.

The research findings from the interviews revealed that in the commercial office space there is a requirement for office interiors to be flexible and adaptable to change of use. That is necessitated by the nature of the fast-moving business environment. What became apparent was that even though most of the times the green office buildings had not been initially designed for adaptability, the buildings had embedded design elements that lent themselves towards adaptability. Interviewee D explained that

"… there is definitely design strategies that are implemented in green buildings which contribute towards the adaptability of the building".

Interviewee A attributed this to good design principles, that as long as a building is designed in adherence with good design principles, the building is likely to end up being adaptable,

"…as long as you apply the good design principles, then there will be a good accommodation of adaptability". **Interviewee A**

This is in line with what discussed in the literature review that in most projects building adaptability is not planned into the project but is rather haphazardly incorporated (Schmidt III *et al.*, 2010).

Although the word 'adaptability' was not often used by interviewees to describe the spaces, different terminology was used instead. Words like, flexibility, demountable walls, design for dissemble were frequently used in the conversations. For instance, Interview G mentioned that one of the green office buildings projects previously involved on, had a retail outlet on the ground floor, with two floors of office space above that were designed to be flexible to multiple tenant use. The interviewee had this say;

"… The office portions were designed to be flexible in terms of office usage, so multi tenanted, single tenant, multi tenants per floor, multi-tenant across floors"

Interviewee A noted that building adaptability is often not a priority that is focused on during the design of green commercial office buildings. However, because the nature of the industry and efforts to meets the needs of various tenant, there is a lot of flexibility in the design and the use of open spaces with demountable walls that eventually lands the spaces to be adaptable by default. Interviewee D reckoned that

"… building adaptability is a relatively new strategy of designing" especially in the South African context and not a lot of green buildings are designed with adaptability in mind. **Interviewee D**

What also became clear from the interviews was that although most of the interviewees spoke of flexible and adaptable interiors in the office spaces, the only adaptability that was accommodated and anticipated for was the change of use of the spaces within the building by different tenants without changing entirely the functionality of the building. This means that the primary function of the building does not change i.e. it remains an office building whilst still allowing various tenants to occupy the spaces within, as opposed to a complete change of use of a structure, for instance, to a residential apartment. Interviewee H explained that *"lots of the new office buildings are designed to be inter-changeable with tenants, not necessarily with use"*. This is the within-use adaptability that was described by Ellison and Sayce (2007) and Wilkinson *et al.* (2009) in the literature review.

4.8.2 Methods of Incorporating Building Adaptability in Green Building Designs

Different ways of incorporating adaptability in the construction of green commercial office buildings were stated by respondents. Most of the respondents stressed the importance of flexible interior spaces in the construction of commercial office buildings. The interior environment of a building changes swiftly, hence the need for flexibility and adaptability. Interviewee G explained that the swift manner in which the market changes is what drives building adaptability because;

"while they are busy building a building, the market might even change in that span". **Interviewee G**

Interviewee A mentioned the importance of incorporating open floor plates that allow flexibility and results in less demolition of walls in the event that there is a need to convert the building to a different use. Another design element that enhances building adaptability that the interviewee mentioned is designing a building in such a way that all essential services are efficiently coordinated and centrally located. These services could be, for instance, electrical and mechanical conduits reticulating air-conditioning systems. The same sentiments were echoed by Interviewee G and Interviewee H. Centrally located services allows services to be connected and disconnected as per requirement without the need to reconfigure the whole system.

Interviewee H mentioned the use of modular patterns as well as demountable walls such as the use of dry partitions in the offices. As an example, this interviewee described an experience of working on

a project that incorporated glazing panels arranged in a modular pattern on the external wall façade. The glazing panels could be disassembled when it becomes necessary, in the event that that the functionality of the building in future changes. Interviewee B cited the use of *"bigger open plan spaces that you can remodel according to change of use*" as another design strategy of incorporating adaptability in the building.

Interviewee E emphasised the importance of designing structures that have an ability to be dismantled later on.

"…yes, so we do have some projects like that where, for instance, you design with the ability to dismantle parts of it. If, for argument's sake, you have a steel structure, steel, because everything is connected together, is bolted together, you can assemble it on site and that means you can also disassemble it fairly easy. If you are looking at being very adaptable in the building sense, you have to consider the construction material itself, to allow for a fairly easy change in geometry of the building or design. Whereas concrete is far more permanent and its usually cast on site". **Interviewee E**

The interviewee suggested precast concrete as an alternative to cast in-situ concrete because precast concrete allows members to be assembled and disassembled on site. However, the interviewee expressed discomfort in designing for adaptability from a structural point of view because of the fact that it comes with a lot of complexities that are not encountered on traditional building construction.

"*… because the building as a whole works in a certain way, and if you start removing parts of it, the whole building system changes*". **Interviewee E**

4.8 THE SIGNIFICANCE OF BUILDING ADAPTABILITY IN GREEN BUILDINGS

The views and perceptions of respondents were sought out in order to get an understanding of the precipitating reasons why building adaptability should be a consideration in the construction of green buildings. That objective here was to discover how and why building adaptability is important in the agenda of green buildings. The basic quest was to find out if there are any benefits of incorporating building adaptability in the design and construction of green buildings, from the lenses of the respondents.

4.8.1 The Contribution of Building Adaptability to Sustainability of Green Buildings

In the literature review, Dwaikat and Ali (2016) mentioned that green buildings are structures that do not have a negative exertion on the environment. It is for this reason that Falkenbach *et al.* (2010) assert that green buildings are synonymous with sustainability of buildings. On the other hand Collins *et al.* (2010) describes adaptable buildings as sustainable buildings. It was therefore, important to understand, from the point of view of respondents how building adaptability contributes to sustainability of green buildings. Interviewee D emphasised the interconnectivity of building adaptability and sustainability in general by stating:

"… You can look at adaptability of a building from an environmental performance of the building as well because the more adaptable the building is, the less resources and the less negative effect you have on the environment. To my mind, you cannot differentiate between adaptability and sustainability. When you design a green building, you will be thinking in line of adaptability as well" **Interviewee D**

4.8.1.1 Extension of Building Lifespan

Interviewee E stated that the importance of building adaptability is that it enables buildings to have an extended lifespan so that they are able to stay in services longer, which ultimately reduces obsolescence in buildings. According to Interviewee B the ability of a building to have an increased lifespan *"makes the building timeless"*. Interviewee E illustrated this by citing an example of a developer who needs to consider the use of the property beyond its long-term lease,

"… if a developer knows he has a client who has a lease for the next 10 years, he has to consider what happens after those 10 years, because the building still has lifespan in it and it needs to be able to adapt to whoever might want to use the building 10 years down the line. The longer you can effectively use the building in its current state, the better for life cycle analysis of the building, the better for the green star rating". **Interviewee E**

The Interviewee went on to emphasise the importance of considering sustainability of a building in terms of its lifespan:

"… if you build something that is only valid for that one event and becomes obsolete afterwards, that is not sustainability. Sustainability is considering not just the materials and how environmentally friendly a material is. It is also about the lifespan of the building itself". **Interviewee E**

The importance of the lifespan of buildings on sustainability was also expressed by Interviewee G;

"… I think buildings should be adaptable in general, which would expand or extend their life on earth, if you can say it like that. I think a lot of buildings get broken down too quickly because there is a change in the market" **Interviewee G**

In literature review Remøy *et al.* (2011) viewed building adaptability as a tool that can be used to extend the functional lifespan of a building. The same view is shared by (Moffatt and Russell, 2001; Langston, 2010; Geraedts *et al.*, 2014) who perceive building adaptability as a strategy that can be used to prolong the useful life of buildings. Extending the useful life of a building means that the building is not prematurely demolished because of obsolescence, which has a positive effect on the environment (Kestner and Webster, 2010). Consequently, there are less demolitions, less pollution and dust, less material wastage, less gas emissions and energy loss through the processes of extraction and manufacturing of new building materials as well as transporting them to site (Bullen, 2007; Velthuis and Spennemann, 2007; Bullen and Love, 2009; Kestner and Webster, 2010). According to Moffatt and Russell (2001) the longer a building remains useful and in service, the more environmentally sustainable it is during its lifespan.

4.8.1.2 Less Demolition Work Involved

Interviewee A explained that the importance of adaptable buildings is that it significantly minimises demolitions in the event that the functionality of a building changes. The interviewee continued to mention that converting a traditional building to a different use involves *"…a lot of demolition work, a lot of interventions to be made on the floor plates to accommodate the new use".*

Interviewee B indicated that there is a lot of conversion projects currently happening in the Johannesburg inner city where a lot of offices are being converted to residential apartments. The conversion processes however, involve massive demolitions because the old buildings were not constructed to be adaptable to a change of use. Interviewee D also alluded to the same conversion developments happening in the inner city of Johannesburg as an example of buildings changing use,

and furthermore emphasised that essentially, any building can be converted to a new use but usually at a cost in terms of demolitions and loss of energy. Interview H explained that demolitions done in order to construct new buildings are a waste of resources and energy;

"…because making new materials is very energy intensive. It takes a lot less energy to knock something down and reuse the material, than to say, no, I want new bricks". **Interviewee H**

Interview A also concurred with that thinking by adding that:

"…apart from adding costs to the project, its additional man-hours, additional building materials and additional labour. That means a higher carbon foot print". **Interviewee A**

Interviewee G said that it is important that green buildings are designed and constructed with adaptability in mind so that the buildings are resilient to rapid market changes in South Africa because sometimes it can happen that

"…while they are busy building a building, the market might even change in that span". **Interviewee G**

Interviewee I buttressed the implication of demolition of buildings in order to build new ones in the following statement:

"…clearly over time we are going to be using more resources, we are going to keep consuming a lot of energy, our buildings are not going to run efficiently. We are going to keep demolishing because the needs of the people are changing and our buildings are not able to accommodate that. We are going to have to keep demolishing the structures, building other ones, and thus working in reverse" **Interviewee I**.

Bullen and Love (2011a) assert that demolition is a wasteful and an environmentally unsustainable way of dealing with building obsolescence. Instead, adaptive reuse of buildings is environmentally sustainable and contributes to the lowering of carbon emissions to the atmosphere (Kurul, 2007). The process of demolition results in a loss of embodied energy and carbon dioxide gas emission (Wang *et al.*, 2016). Furthermore, the disposal of the building material from the demolition has a negative effect on the environment because of pollution dust and noise (Kestner and Webster, 2010).

4.8.1.3 Material Wastage and Reuse

Material loss through demolition was another concern that was expressed by some of the interviewees. Interviewee F mentioned that reusing demolished material is considered a green principle because the materials do not end up in a landfill affecting the environment negatively. Interviewee B explained the importance of material reuse when a building is converted to a new use;

"… you don't want to end up using a lot of materials or more than half the materials, or introducing new materials to a building, then it's as good as actually, almost, building another building. So, adaptability should be incorporated into the building". **Interviewee B**

Interviewee A explained that on traditional buildings that are not built with adaptability, most of the times the demolished materials become unusable and are often thrown away. Interviewee I emphases the importance of adaptable green building in order to prevent material loss;

"…if you are truly designing a green building, then it means that it should be adaptable, because what we are trying to do right now, is trying to make sure that we are reducing the amount of raw materials we are using". **Interviewee I**

Interviewee D summarised the issue by saying "… *the more adaptable the building is, the less resources and less negative effect you have on the environment*".

There is minimum demolition involved on adaptive buildings compared to non-adaptive buildings, hence there is less material and energy consumption (Collins *et al.*, 2010). Demolishing of a building for the sake of rebuilding another one is not sustainable socially, economically and environmentally because rebuilding entails extraction of new raw materials, manufacturing of new materials and transportation of the materials to site, all of which is high in energy consumption and gas emission (Bullen, 2007). Another source of embodied energy loss, as explained by Wang *et al.* (2016) occurs during the process of raw material extraction, manufacturing and transportation of material to site. The more delivery trips and loads to a site the more carbon emitted to the atmosphere and the more energy consumption and loss (Collins *et al.*, 2010). One of the greatest values of building adaptability is that it allows the demolished materials to be reused or recycled because, to start with, often such building materials would have been selected for construction based on their reusability and deconstructability qualities (Kestner and Webster, 2010).

Table 4.4 below shows the results of the questionnaire survey on the opinions of respondents on how much they agreed to the fairness of expecting green buildings to be constructed with elements of adaptability in order to ensure long-term sustainability of the buildings.

	Architects		**Engineers**		**Sustainability Consultants**		**Total**	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Neither Agree nor Disagree	1	5%	2	10%	1	20%	4	8.89%
Agree	13	65%	11	55%	0	0%	24	53.33%
Strongly Agree	6	30%	7	35%	4	80%	17	37.78%
Totals	**20**	**100%**	**20**	**100%**	**5**	**100%**	**45**	**100%**

Table 4.4: Fairness of green buildings being constructed with adaptability

The findings show that the majority of the respondents (91.11%) believed green buildings should be constructed with elements of adaptability. Only 8.89% of the respondents were uncertain, as shown by their neutral position on the matter. Adaptive green buildings ensure the sustainability of the buildings not only in terms of energy efficiency but also in terms of the buildings being able to adapt easily to change of use (Marciniak, 2015).

The significance of building adaptability in the sustainability agenda of green buildings was also interrogated in the questionnaire survey. Below on Table 4.5 are the results of the survey:

	Architects		**Engineers**		**Sustainability Consultants**		**Total**	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Not so Significant	0	0%	1	5%	0	0%	1	2.22%
Somehow Significant	7	35%	2	10%	1	20%	10	22.22%
Very Significant	11	55%	13	65%	1	20%	25	55.56%
Extremely Significant	2	10%	4	20%	3	60%	9	20%
Totals	**20**	**100%**	**20**	**100%**	**5**	**100%**	**45**	**100%**

Table 4.5: Significance of building adaptability in the sustainability of green buildings

From the table above, only one respondent said the concept of building adaptability is not so significant in the sustainability agenda of green buildings. Over half of the respondents (55.56%) believed that building adaptability is very significant whilst 20% said it is extremely significant. Just as the findings from the interviews, the respondents of the survey recognised the significance of building adaptability in the sustainability of green buildings. In the literature Estaji (2017) explained that any building construction that does not embrace the idea of change and reuse can only give an illusion of sustainability.

4.8.2 The Relationship of Building Adaptability to Green buildings

On the question of the connection between adaptable buildings and green buildings, Interviewee D said the essentially the two concepts cannot be separated.

"… what I can say from defining green buildings, in principle, is that you cannot look at the two terms completely in isolation because, intrinsically, a green building is supposed to be an adaptable building". **Interviewee D**

Interviewee I concurred with the same sentiments, that essentially an adaptable building is a green building because *"…green buildings and adaptability cannot be separated".*

The connection strength of the relationship between building adaptability and green buildings was interrogated on the questionnaire survey and the results are illustrated in Figure 4.5 below:

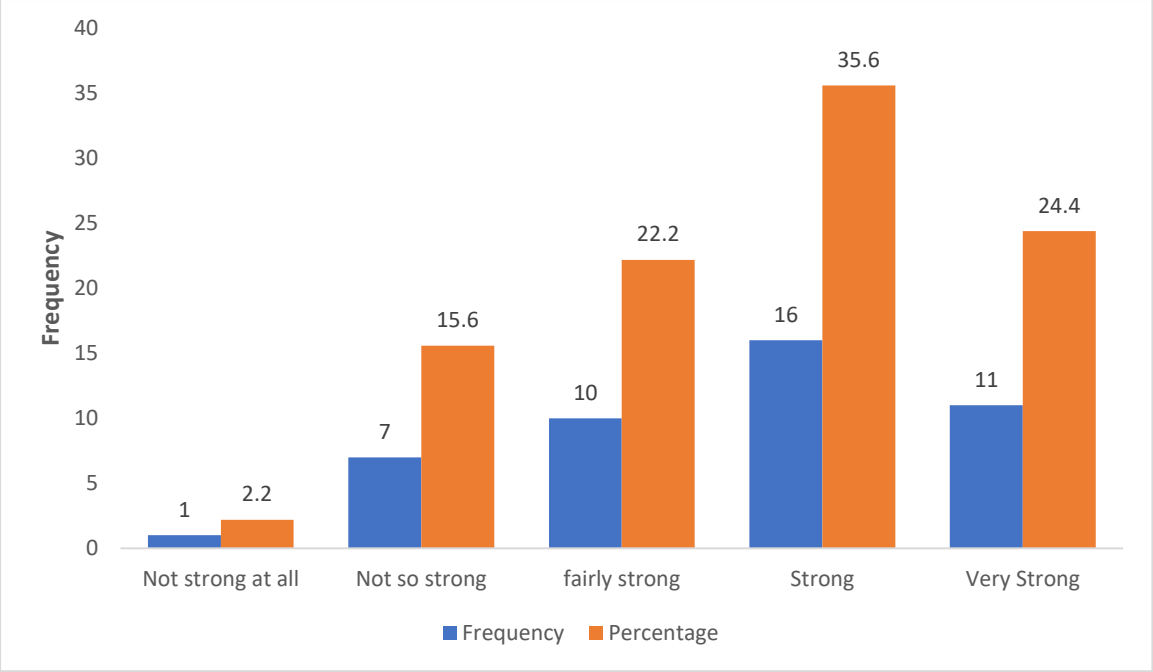


Fig 4.5: The strength of the relationship between building adaptability and green buildings

More than half of the respondents (60%) were of the opinion that there is a strong connection between building adaptability and green buildings. however, eight of the respondents thought that the connection is not strong. The findings are in agreement with an assertion by Manewa *et al.* (2016) that adaptable buildings are sustainable buildings and that essentially, an adaptable building is a green building. Geraedts (2016) also concedes that adaptative buildings are green buildings because they are both environmentally sustainable.

However, although Interviewee G agreed that all green buildings should be adaptable, the reality is that most green buildings in South Africa are not constructed with adaptability. The interviewee advised as follows;

"*… there needs to be a mentality shift from the building owners and building contractors in terms of what does adaptability means later on"*. **Interviewee G**

Interviewee A also stated the interests of some developers are an impediment to the adoption of adaptability in the construction of green buildings:

"*… some developers purely develop the building to develop, built it and then sell it, and they don't care what happens afterwards*". **Interviewee A**

This is what was explained by Arge (2005) and Remøy *et al.* (2011) that developers and investors who develop property for the sole purpose of resale only have a short term interest on the property and therefore may not be interested in investing in sustainable adaptable buildings because they are not the ones who would eventually reap the benefits of it. Such developers are motivated by profits and are not willing to pay the cost of adaptability for future benefits that would be experienced by future end users of the building.

Interviewee H, although essentially agreeing that all green buildings should be adaptable, cautioned against the tendency to overdesign building structures in an effort to make them adaptable to unknown future changes. The Interviewee emphasised the importance of finding a balance between

designing for present building needs and designing for future anticipated and unknown building needs. This is what the interviewee said on the matter;

"in my opinion, you should always allow for different tenants to come in, and to a certain extent, you can allow for different uses. However, I do not think it is very responsible to always say, what if the building in 50 years, we want to turn it into a residential building, because then you compromise what this building is now, and compromise how it functions now for a 'what if' in the future. You have to put that in balance". **Interviewee H**

Pinder *et al.* (2011) referred to this as future proofing, that designers always have to be cautious about it because it usually has unintended consequences of increasing construction costs, that would eventually be passed on to tenants in the form of high rentals. Over-designing and future proofing can be a barrier that hinder the adoption of building adaptability because they lead to a perception that adaptability is costly.

On the other hand, Interview B indicated that not all green buildings should be built with adaptability because it may not always be practical to achieve that. The Interviewee elaborated that highly specialised buildings like clinics and hospitals are difficult to design for a different use because they

"… come with a whole lot of equipment that needs to be specialised in terms of how they are serviced and accommodated. Such kind of buildings are highly specialised". **Interviewee B**

The interviewee however, added that although it is not impossible to design them for adaptability, it would, inevitably, come at an exorbitant price. That notion is consistent with what was stated by Kestner and Webster (2010) that adaptability is less useful and profitable for building structures that are not likely to change functionality over their entire lifespan, such as clinics, hospitals, museums, cathedrals, etc.

4.9 THE RATING CRITERIA OF GREEN BUILDING

After interrogating the sustainability of green building and understanding the contribution of building adaptability in that agenda, it was important to shift attention to the rating criteria of green buildings in South Africa, in order to understand how they are rated and how building adaptability contributes to the rating.

4.9.1 The Contribution of building Adaptability to the Rating Criteria of Green Buildings

What became apparent from all the interviews except one, was that the term adaptability is not there on the green star rating tools in South Africa. Currently, GBCSA has no rating tool that has been designed specifically to target building adaptability. Furthermore, the terminology used in the rating tools is silent on building adaptability and hence there are no specific requirements that the GBCSA has set for a holistic accreditation of adaptability per se. The following statements are some of the extracts from the interviews on the subject.

"… adaptability per se, is not one of those credits or categories that we have within the green star rating system". **Interviewee I**

"… I don't think they really measure building adaptability. They measure the re-use of the materials quite well, but I do not think they measure adaptability strongly". **Interviewee H**

"… No, I don't think so. You know, the tools were specifically designed to measure the environmental performance of buildings. But the schemes, per se, do not have a specific requirement for adaptability at large to be implemented in design". **Interviewee D**

"… We don't even account for it in any way. It's not even a thing that is looked at". **Interviewee C**

4.9.1.1 Design for Disassembly Rating Criteria

Nevertheless, even though findings from the interviews revealed that the rating tools do not make mention of adaptability in a specific way, there are *"elements that support adaptability"* which are recognised and awarded for, as was explained by Interviewee I. Such elements are design for disassembly and material reuse. What the interviews revealed is that although the terminology of adaptability is not in existence in the language of rating criteria for green buildings, the word flexibility was used frequently by the interviewees. Most of the interviewees concurred that although there is no rating criteria that targets adaptability per se, there are credits earned for design for disassembly on interior spaces, as well as material re-use, which are both elements of building adaptability.

Design for disassembly is also known interchangeably as design for deconstruction or design for dismantle (Graham, 2005). The interviews revealed that design for disassembly is an important aspect of green commercial offices. Most of the interviewees concurred that the interiors of commercial offices have a requirement for flexibility and to be adaptive to change of tenant use of space, due to the fast-changing nature of business. Interview D elaborated on this point as follows;

"… the interior should be aligned with the function of the tenant, which means that if the tenant's functionality changes, if the tenant requires anything else in future, the area within could be changed as well". **Interviewee D**

Hence, design for disassembly is something that is acknowledged and recognised by the green star rating tools and is awarded points.

4.9.1.2 Material Reuse Rating Criteria

Another element that the rating tools in South Africa recognises is material re-use or recycling. This is applicable on refurbishments and renovation of existing properties. The interviews revealed that points are awarded if it can be shown that the building materials from the demolition can be reused or recycled instead of being deposited at a dumping site where they would have a negative impact on the environment. Interviewee C explained that *"sustainably managing the demolition and refurbishing process"* is one of the green principles that is recognised. Hence, credit is given if the demolished materials can be recycled or re-used in the renovations because it means that there is less material wastage.

The following table shows the findings of the questionnaire survey regarding the degree of contribution building adaptability has on the rating criteria of green buildings.

	Architects		**Engineers**		**Sustainability Consultants**		**Total**	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
None at all	1	5%	0	0%	2	40%	3	6.67%
A little	4	20%	0	0%	1	20%	5	11.11%
Moderate Amount	7	35%	6	30%	1	20%	14	31.11%
A lot	6	30%	8	40%	1	20%	15	33.33%
A Great Deal	2	10%	6	30%	0	0%	8	17.78%
Totals	**20**	**100%**	**20**	**100%**	**5**	**100%**	**45**	**100%**

Table 4.6: Degree of contribution of building adaptability to the rating criteria of green buildings

The findings from the survey indicated that the majority of the respondents (51.11%) believe that building adaptability plays big role in the rating criteria of green buildings. Three (6.67%) of the respondents said that building adaptability does not contribute at all to the rating criteria of green buildings, whilst 31.11% of the respondents said building adaptability has a moderate contribution. The findings of the questionnaire survey are contrary to the findings of the interviews. In the literature, Gunnell *et al.* (2009) argued that the current environmental rating tools are not sustainable because they do not take into consideration all the aspects of sustainability holistically.

To take the discussion further, respondents were asked how much they agree that building adaptability should be one of the rating criteria of green building. The findings are tabulated below:

	Architects		**Engineers**		**Sustainability Consultants**		**Total**	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Strongly Disagree	1	5%	0	0%	0	0%	1	2.22%
Disagree	0	0%	0	0%	1	20%	1	2.22%
Neither Agree nor Disagree	2	10%	5	25%	0	0%	7	15.56%
Agree	10	50%	13	65%	1	20%	24	53.33%
Strongly Agree	7	35%	2	10%	3	60%	12	26.67%
Totals	**20**	**100%**	**20**	**100%**	**5**	**100%**	**45**	**100%**

Table 4.7: Consideration of building adaptability as one of the rating criteria for green buildings

The results indicate that majority of the respondents (80%) agreed that building adaptability should be considered as one of the rating criteria for green buildings. However, two of the respondents disagreed that building adaptability should be considered as a rating criteria for green buildings while 15.56% of the respondents took a neutral position of neither agreeing nor disagreeing to the notion.

The findings are consistent with what was uncovered on the interviews because all the interviewees acknowledged the importance of incorporating building adaptability in the rating criteria of green buildings.

4.9.2 The Adequacy of the Current Rating Criteria of Green Buildings

Most of the interviewees concurred with the inadequacy of the current assessment tools used in South Africa to rate green buildings. Interviewee D summed it up by saying

"… there is no defined tool or defined specifications and definitions of what makes a building adaptable and how to achieve this status of adaptability".

Interviewees concurred that there is a lot more that could be done to improve the current rating criteria of green buildings in South Africa. Interviewee I expressed dissatisfaction with the current rating tools with regards to building adaptability. The following statement expresses the interviewee's dissatisfaction on the subject:

"… I think looking at where the market is currently and where we come from in terms of sustainability generally in South African context, although they are not as rigorous as they are supposed to be in terms of managing and encouraging building adaptability, they are trying. But we need them to be more rigorous and more straightforward. At this point in time, it's a bit indirect although it's there. We need that to come up with certain credits that directly look and assess building adaptability" **Interview I**

Similar sentiments were alluded to by Interview G that the current rating tools in South Africa need to be enhanced so that they are able to measure building adaptability more adequately. The Interviewee made comparison of current rating tools in South Africa to other international rating systems, in terms of adaptability.

"… I think it can be enhanced a bit more, if you look at the green star rating system. I think most of the international systems look a lot more at adaptability than the South African rating system". **Interviewee G**

Interviewee F attributed the inadequacy of green building rating tools in incorporating building adaptability as a rating criteria to the fact that currently, there is no demand and market for adaptable buildings in South Africa, compared to other countries where there are massive shortages of land for new developments, such that developers there are forced to develop adaptable buildings that can be easily changed to other uses. Bullen (2007) explains that in industrial countries where land is scarce, construction of new buildings is discouraged in favour of adopting existing structures.

Interviewee G expressed pessimism towards the general way green buildings are certified in that

"developers and commercial builders have become very smart in that they know which boxes to tick to get a 4-star or 5-star rating". **Interviewee G**

Interview A concurred with the same sentiments that rating tools are sometimes used to just tick boxes and;

"… just to put this label, this fancy label on the building, saying like, look we build and designed a green building". **Interviewee A**

However, Interviewee B was the only one to express satisfaction with the adequacy of the ability of the current rating tools in measuring the adaptability of green buildings. The Interviewee asserted that there is already a framework criteria in existence for adaptability and that additional points can be claimed through the innovation tool which awards for innovative designs and ideas in green buildings.

"… Issues like adaptability, they have already been catered for. Once you want to claim points based on adaptability, there is a criteria in the framework that you can use to claim those points. They are adequate. There is obviously, additional points that you can claim through innovation, which means, if your adaptability or adaptation initiatives are actually not catered for, you can actually introduce new ones and then claim under innovation, so you score points". **Interviewee B**

As a solution on the way forward, Interviewee D suggested that instead of designing a new separate rating tool for building adaptability, GBCSA should consider extending some of the current existing tools to accommodate adaptability with more specificity. The same sentiments were share by Interviewee G who said;

"… it doesn't necessarily have to be a standalone tool. It just has to be coined, nicely coined within the existing tools that we have". **Interviewee G**

Respondents on the questionnaire survey were asked on the adequacy of the current assessment tools used in South Africa to rate green buildings and the findings are tabulated below on Table 4.8

	Architects		**Engineers**		**Sustainability Consultants**		**Total**	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Extremely Inadequate	1	5%	1	5%	2	40%	4	8.89%
Very Inadequate	1	5%	1	5%	1	20%	3	6.67%
Inadequate	9	45%	5	25%	1	20%	15	33.33%
Adequate	5	25%	9	45%	0	0%	14	31.11%
Very Adequate	4	20%	4	20%	1	20%	9	20%
Totals	**20**	**100%**	**20**	**100%**	**5**	**100%**	**45**	**100%**

Table 4.8: The adequacy of current assessment tools in rating green buildings

Just above half of the respondents (51.11%) said that there is adequacy in the way green buildings are rated by the current assessment tools, while 33.33% of the respondents said the rating system is inadequate. Four respondents (8.89%) thought the rating system is extremely inadequate whilst another three (6.67%) said it is very inadequate.

The questionnaire findings are incongruent to the interview findings where eight of the nine interviewees said the current rating tools are inadequate in rating green buildings. In literature, Wang

et al. (2016) stated that suitability and adequacy of the current rating system of green building is questionable.

Furthermore, the satisfaction of the respondents on the current rating system for green buildings are interrogated in order to ascertain levels of satisfaction with the system within the professionals in the built environment of South Africa. The results are shown below on Table 4.9

	Architects		**Engineers**		**Sustainability Consultants**		**Total**	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Very Dissatisfied	0	0%	1	5%	3	60%	4	8.89%
Dissatisfied	2	10%	2	10%	1	20%	5	11.11%
Neither Dissatisfied nor Satisfied	12	60%	11	55%	0	0%	23	51.11%
Satisfied	4	20%	6	30%	0	0%	10	22.22%
Very Satisfied	2	10%	0	0%	1	20%	3	6.67%
Totals	**20**	**100%**	**20**	**100%**	**5**	**100%**	**45**	**100%**

Table 4.9: The degree of satisfaction of the current rating tools for green buildings

A total of 20% of the respondents expressed dissatisfaction with the current rating tools for green buildings whilst a total of 28.89% of the respondents were satisfied with the current rating system. The majority of the respondents (51.11%) were neither satisfied nor dissatisfied by the current system of rating green buildings. The findings of the questionnaire survey are not in line with the findings from the interviews where most of the interviewees said there is room for improvement on the current rating system.

4.10 CHAPTER SUMMARY

In summary, the findings of the data collected indicated that the level of familiarity of adaptability by professionals in the built environment of South Africa is minimal. The majority of the respondents from the questionnaire survey had little to moderate familiarity with the concept of adaptability. Interviews revealed that professionals are not familiar with the terminology of adaptability, though the concept is known and understood. Most of the respondents acquired their knowledge of building adaptability from work rather than from tertiary education, because most of this knowledge is project based.

Most of the respondents from the questionnaire survey had little knowledge of adaptable green buildings because a lot of green buildings in South Africa are not necessarily built with adaptability in mind. However, the interviews revealed that knowledge of adaptable green building is higher because of the nature of the business of commercial office buildings which requires the building interiors to be flexible and adaptable to change of use in order to minimise inconveniences between tenants moving in and out. The research findings also revealed that commercial office buildings are mostly designed for within-use adaptability and not across-use adaptability.

Most of the respondents concurred that building adaptability is important in the sustainability agenda of green buildings because it increases the lifespan of buildings, minimises demolition and wastage of building materials. The connection between building adaptability and green buildings was acknowledged by most respondents because the two concepts cannot be isolated from each other since inherently, all green buildings should be adaptable to change of use if they are to remain sustainable.

However, most of the respondents expressed dissatisfaction with the adequacy of rating tools in South Africa in measuring building adaptability. Although the current rating tools are able to measure some form of adaptability such as design for disassembly and material re-use, the tools do not have specific requirements that target adaptability holistically. Respondents suggested that GBCSA should extend their rating tools to include building adaptability to be one of the rating criteria for green buildings.

The amount of awareness of the concept of building adaptability in South Africa is little. Adaptability is not a topical subject and there is low demand for adaptable buildings compared to other countries internationally where there are shortages of building land. Respondents suggested including adaptability in tertiary curriculum courses so that students are informed and knowledgeable about the concept, and eventually champion it later at their workplaces and projects, as a way of raising awareness.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.0 CHAPTER OVERVIEW

This chapter is a summary of the findings of the research as discussed on the previous chapter. From the research findings, conclusions and recommendations are drawn. The chapter comes full circle to evaluate the research question and objectives that were set out in Chapter 1 at the beginning of the study.

5.1 REVIEW OF RESEARCH OBJECTIVES

All the objectives are reviewed individually to unpack how the research managed to address them. To do this, conclusions are drawn from the literature review and findings from the questionnaire survey and interviews.

5.1.1 Investigate the connection between building adaptability and green buildings

The literature review and findings from interviews revealed that the connection between building adaptability and green buildings is that both are environmentally sustainable. As such green buildings have come to be recognised as a flagship for environmental sustainability. They are high performance facilities that impose minimum negative impact on the environment. Green buildings are known for being energy efficient during their operations and as such the sustainability of green building is measured during the operation stage of a building lifecycle.

Through literature the importance of viewing the sustainability of buildings holistically was revealed. Both literature and research findings identified that adaptive buildings are sustainable buildings. Adaptive buildings are environmentally sustainable because of their ability to respond to change with minimum demolitions to the structure. Less demolitions mean firstly, that there is less pollution and dust emitted to the atmosphere, and secondly, that there is a reduced need to bring in new building materials into the construction. The importance of this is that there is less consumption of resources and energy. Firstly, few materials are deposited on dumping site to pollute the environment. Secondly, often the materials from the demolition could be reused or recycled because most likely they would have been chosen because of their reusability and ease for dismantling to start with. Even in cases where the materials cannot be reused, the fact that there is less demolitions means that the amount of new building materials brought back into refurbishment is reduced substantially. That entails furthermore, that there would less extraction of raw materials, less manufacturing of new materials and fewer delivery loads to site, thereby reducing energy consumption from embodied energies. Thus, Estaji (2017) pronounced that any building construction that is not embracive to flexibility of change of use can only give an illusion of sustainability in the long-run.

Research also established that building adaptability is sustainable because it helps to prolong the lifespan of buildings thereby preventing premature obsolescence of buildings. The longer a building remains in service the more environmentally sustainable it becomes (Moffatt and Russell, 2001). Research also highlighted that intrinsically, an adaptable building is a green building because the two concepts cannot be separated nor can they exist in isolation to each other. The research also established that there is a strong connection that exists between building adaptability and green buildings.

5.1.2 Explore the extent to which professionals in the built environment of South Africa incorporate building adaptability strategies in the design and construction of green buildings.

Research showed design for adaptability is a relatively new phenomenon in South Africa. This was shown by examples of massive demolitions involved in the conversion of old office buildings to student and residential apartments in the inner-city centres such as Johannesburg because the buildings were designed and constructed for single use and converting them to a different use came at a cost of time, price, material wastage, loss of income and productivity, inconveniences to building occupants, and pollution to the environment.

Research further indicated that in general, most of the current green buildings in South Africa were not designed and constructed with adaptability in mind. Most professionals in the built environment of South Africa are not very familiar with the concept of building adaptability. However, though adaptability may not be planned into the design, research established that adhering to good design principles when designing for green buildings often results in building structures that are flexible and adaptable to change by default.

Findings from the research showed that there is little building adaptability incorporated in the design and construction of green buildings. The adaptability strategy used on green commercial office buildings is design for disassembly. This is because of the nature of the fast-paced business environment requires that the building interiors be flexible to a change of use by different tenants. Design for disassembly is a strategy employed to achieve flexibility and ease of dismantling. The use of drywall partitions is prominent in commercial office spaces, which also make it easy to assemble and disassemble on site.

What was also revealed by the research is that where the green office buildings had some level of adaptability, only within-use adaptability was implemented. Most of the commercial office buildings are constructed to allow for change of use of space by different tenants but not for a complete change of functionality and use of the building.

5.1.3 Assess how building adaptability contributes to the criteria of rating green buildings.

Research established that the terminology of the current rating tools is silent on building adaptability and that there are no specific requirements that targets for building adaptability per se. Nevertheless, even though there is no check box for adaptability, the GBCSA green star does give credits for adaptability elements such as design for disassembly and material reuse. Those are the elements of adaptability that are recognised and that contribute to rating criteria of green buildings when incorporated in the construction of green buildings.

5.1.4 Identify ways of raising awareness of building adaptability in order that it is adopted in the design and construction of green buildings.

Raising the level of awareness is important if building adaptability is to become a main stream design principle in South Africa. Research indicated that there is not a lot of awareness of building adaptability because it is not a topical subject among the built environment professionals of South Africa. Awareness of building adaptability is mostly acquired at work because the knowledge of the concept is often project driven.

Research indicated that tertiary institutions could provide a starting point of raising the awareness of building adaptability by incorporating it into their academic modules taught to students. The students would then carry forward and spread the knowledge of the concept into their work places and be able

to influence sustainability decisions and designs on projects. Therefore, incorporating building adaptability in modules of all built environment students would be fruitful in raising awareness of the subject.

Incorporating building adaptability as one of the rating criteria of green buildings is another way of raising awareness that came out from the research. This would require the GBCSA to extend their existing green star rating tools to target building adaptability directly in order to ensure that there are clear and specific requirements for achieving adaptability goals when rating green buildings. Recognising and awarding adaptive initiatives in buildings by incorporating building adaptability as one of the rating criteria for green buildings would in turn encourage creativity and innovation of building designs and construction, and hence spread awareness in the built environment industry of South Africa.

Research also identified that another way the GBCSA can promote awareness and growth of the building adaptability is for the council to incorporate it into their Continual Development Programme (CPD) as one of the professional skills development programmes offered to their members. This would enable all the affiliated professionals an opportunity to learn and acquire acknowledge around the subject so that they can implement it in their green building projects.

Providing incentives for investors and developers to build more adaptable green buildings is another way of increasing awareness on the subject of building adaptability that the research identified. For instance, providing tax rebates on adaptive building developments is one way of attracting the attention of investors, as was indicated by the research.

5.2 RESEARCH QUESTION

The research question that was posed at the beginning of this study is the following:

What level of building adaptability is incorporated into the design and construction of green buildings in South Africa?

Research indicated that building adaptability is a relatively new design concept in South Africa, hence most of the current existing green buildings were not constructed with adaptability in mind. Although some of the commercial green offices were constructed with some level of adaptability in the form of flexible tenant fitouts, research showed that there is little adaptability incorporated on the design and construction of the green buildings. Building adaptability seems to be unplanned for and is mostly incorporated by default.

5.3 CONCLUSION

Research indicated that the concept of building adaptability is not fully embraced as a design principle for green buildings largely because they are no rewards or incentives, in the form of green star points, attached with designing for adaptability. Although the current rating tools for green buildings do award points for elements of building adaptability, the tools are generally silent on building adaptability as a whole. There is no terminology that speaks directly to the adaptability and they are no specific requirements in the current rating tools that target building adaptability holistically. Hence the proposition that was stated in Chapter 1 that building adaptability is not yet entrenched as one of the criteria of rating green buildings in South Africa is supported. The phenomenon of green buildings fairly new principle in the construction industry of South Africa, that has however, received increasing attention and awareness over the years. However, the issue of the sustainability of green buildings is often viewed one-dimensional, in terms of in-door environment conditions of the buildings. Consequently, important matters such as the ease at which green buildings adapt to change of use

and how that change ultimately affects the sustainability of such buildings is not fully considered and evaluated in the accreditation of green buildings.

5.4 LIMITATIONS OF THE RESEARCH STUDY

In the process of gathering information and compiling this report, there were challenges that were encountered along the way. The first challenge was that there were few recent journal articles on building adaptability, especially in the context of the local built environment of South Africa. Consequently, most of the journal articles used were ten years or older. The second challenge was encountered during the data collection process where access to disseminate questionnaires to professional bodies such as GBCSA, SACAP and ECSA was not permitted. This made it difficult to collect a large sample size for the quantitative data.

5.5 RECOMMENDATIONS

The study showed that there is little knowledge and awareness of building adaptability within the professionals in the built environment of South Africa. The following ways are recommended to raise awareness and build momentum on adaptability;

1. More education is needed on building adaptability. This would improve knowledge and awareness on the subject. One way to achieve that is to incorporate building adaptability in the university academic curriculum of all built environment programmes. Another way is for the GBCSA to also incorporate it on the CPD skill development programmes offered to affiliated professionals. This would provide knowledge to professionals who are already practising but who did not have an opportunity to learn about the concept at tertiary institutions. This could also be a way of refreshing knowledge to other professionals who might have briefly encountered it at universities.

2. There is need to have the rating tools for green buildings to be specific on the requirements goals on building adaptability. Since the current rating criteria for green building is silent on building adaptability, the GBCSA needs to extend existing green star rating tools to incorporate building adaptability with more specificity. That would encourage building designers to design more adaptive structures since their efforts would be recognised and awarded.

3. Government has a role to play in improving building adaptability awareness. This could be done by developing an incentive scheme for building developments that incorporate the principles of building adaptability in the design and construction of buildings, to receive tax rebates. Such an initiative would promote and attract interest towards building adaptability. As a result, there would be increased attention and awareness on the subject.

5.6 SUGGESTIONS FOR FURTHER STUDIES

Future studies in the area of building adaptability could focus on the following:

1. Investigation of the interests and perceptions of investors and developers regarding adaptable green buildings.
2. How building investors and developers in South Africa can influence the development and construction of more adaptable buildings.

3. How building adaptability elements can be incorporated in the evaluation of properties as a way of encouraging and promoting the concept.

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APPENDIX A – CONSENT FORM

CONSENT FORM
UNIVERSITY OF CAPE TOWN
CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Research Topic: Evaluating the adaptability of green buildings in the sustainability agenda in South Africa.

Dear potential participant,
You are invited to participate in a research study conducted by Siduduzile Ndiweni, a MSc Property Studies student at the University of Cape Town. The research study is supervised by Karen Le Jeune from the Department of Construction Economics and Management of the University of Cape Town. The results of the research study shall be presented to the Department of Construction Economics and Management in fulfilment of the requirements of the degree in Masters in Property Studies.
Should you have any queries or concerns regarding the research, please feel free to contact me at NDWSID001@myuct.ac.za. The research supervisor Karen Le Jeune can be contacted at karen.lejeune@uct.ac.za

Purpose of the research study
The purpose of this research study is to investigate how building adaptability influences the sustainability of green buildings. This is anticipated to be achieved by:

1. Investigating the link between building adaptability and green buildings.

2. Assessing how adaptability contributes to the sustainability rating of green buildings.

3. Exploring the extent to which stakeholders in the built environment incorporate building adaptability strategies in the designs for green buildings.

4. Identifying drivers that will enable the adoption of building adaptability in the design and construction of green buildings.

Procedure
Your participation in this research study is completely voluntary. Should you volunteer to participate in the research study, we would consult with you in order to agree on a time that would be suitable for a semi-structured face-to-face interview. Various questions shall be asked that will be used to supplement data obtained from documentation analysis under a case study research setup.

Potential benefits to participants
Should you request, the research findings will be shared with you.

Confidentiality
Every effort shall be made in order to ensure that the subjects are anonymous and the safeguard of any information provided. Confidentiality of all information shall be maintained. The information obtained from the interview process shall be used for this research study only. The raw data obtain from the interview shall only be revealed to individuals directly associated to the supervision and marking of this research study.

Participation and Withdrawal
You may elect to withdraw from this study at any time. You may also elect to refuse to answer any question that you do not wish to answer.

Rights of research participants
You may elect to withdraw your consent at any time and discontinue participation without any penalty. This study has been reviewed and granted ethics clearance through the University of Cape Town Research Ethics Board.

Signature of Research Participant/Legal Representative
I have read the information above and my questions have been answered to my satisfaction. I hereby agree to participate in this research study and been given a copy of this form.

…….
Name of Participant

…….
Company of Participant

…….
Signature of Participant

APPENDIX B – INTERVIEW QUESTIONS

SAMPLE OF SEMI-STRUCTURED INTERVIEW QUESTIONS.

1) What is your understanding of adaptability in buildings?

2) Are there any examples of projects that you designed for or that you were involved on, which had elements of building adaptability that you would like to share?

3) If green buildings are about designing buildings today for more sustainable use in the future, to what extent would you agree that adaptability should be an ingrained feature of green buildings?

4) In the green building projects that you have been involved in, how has adaptability been incorporated in the design and construction of the building?

4) What are the possible unique design elements that can be incorporated in the construction of green to make them more adaptable and sustainable?

5) To what extent do you think there exist a connection between green buildings and building adaptability?

6) From your own observation, what are the benefits of building adaptability with regards to the sustainability of green buildings? Are there any negative drawbacks of building adaptability that become a hindrance to implement in the construction of green buildings?

7) In your experience of working in green building projects, how did building adaptability contribute to the rating of the greenness of the building?

8) To what extent are the current environment assessment rating tools adequate in measuring adaptability of commercial green office buildings?

9) How much are you aware of factors that drive building adaptability?

10) What can be possibly done to improve the awareness and use of building adaptability in the design and construction of green buildings in the built environment of South Africa?

APPENDIX C- QUESTIONNAIRE SURVEY

1) In the built environment of South Africa which label best describes the industry that you are in?

- Building & Construction
- Property
- GBCSA

Other, Specify ……

2) Which label best describes your role?

- Architect
- Engineer
- Other, Specify

If Other, please specify

……

3) How long have you worked in the industry as a professional?

- Less than 5years
- 5-10years
- 11-15years
- 16-20years
- > 20years

4) How much familiar are you with the concept of building adaptability?

- Extremely familiar
- Very familiar
- Somewhat familiar
- Not so familiar
- Not at all familiar

5) How did you come to know about the concept of adaptability in buildings?

- From university
- At work
- From colleagues
- Never heard of it

6) What is your level of awareness of any building projects that incorporated adaptability in the construction?

- Extremely high
- Very high
- High
- Extremely low
- Very low
- None

7) To what extent is your knowledge of any green building projects that have incorporated

adaptability in their construction?

- Extremely extensive
- Very extensive
- Extensive
- Limited
- Very limited
- None

8) In your line of work, how much have you experienced working on green building projects that have incorporated the concept of adaptability in construction?

- A lot
- Moderate
- Little
- Very little
- No at all

9) To a scale of 1-10 please rate how much adaptability was incorporated in the design and construction of such green building? 1 indicating least and 10 indicating most.

……

10) How have you ever incorporated building adaptability in any of your green building designs?

……

……

……

11) As a percentage, how much building adaptability have you incorporated in your design of green buildings?

- Less than 10%
- 10%-20%
- More than 20%
- None

12) How important do you think it is to incorporate the principles of adaptability in the design and construction of green buildings?

- Extremely important
- Very important
- Important
- Not so important
- Not important at all

13) How much would you agree that all green buildings should be adaptable?

- Strongly agree

- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree

14) In your opinion how fair is it to say that for long-term sustainability, the construction of green buildings should have elements of adaptability?

- Extremely fair
- Very Fair
- Fair
- Unfair
- Very unfair
- Extremely unfair

15) On a scale of 0-10, 0 indicating no relationship at all and 10 indicating a strong correlation, how much would you rate the relationship that exists between green building and building adaptability?

……..

16) How strong would you consider the link between building adaptability and green buildings?

- Extremely Strong
- Very strong
- Strong
- Fairly Strong
- Not so strong
- Not strong at all

17) To what extent is building adaptability beneficial to the sustainability of green buildings?

- Very great extent
- Great extent
- Some extent
- Little extent
- Very little extent

18) How significant is the concept of building adaptability to the sustainability agenda of green buildings?

- Extremely significant
- Highly significant
- Significant
- Insignificant
- Highly insignificant
- Extremely insignificant

19) How much would you agree that building adaptability is a component of sustainable building?

- Strongly agree

- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

20) How much does building adaptability contribute to the rating system of green buildings?

- A lot
- Moderate
- Little
- Very little
- No at all

21) Would you agree that building adaptability should be considered as one of the criteria for rating green buildings?

- Extremely agree
- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Extremely disagree

22) How much do you agree that building adaptability should be one of the criteria for measuring the greenness of buildings?

- Extremely agree
- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Extremely disagree

23) On a scale of 0-10, to what extent does current rating tools used to rate green buildings in South Africa measure building adaptability as criteria for green buildings?
0 indicating the least extent and 10 indicating the highest extent.

……

24) How adequate do you think the current environmental assessment tools used to rate green buildings in South Africa are in incorporating adaptability as a criteria of rating green buildings?

- Extremely adequate
- Very adequate
- Adequate
- Extremely inadequate
- Very inadequate
- Inadequate

25) How satisfied are you with the current rating tools used in South Africa to measure the adaptability of green buildings?

- Extremely satisfied
- Very satisfied
- Satisfied
- Dissatisfied
- Very dissatisfied
- Extremely dissatisfied

26) What do you think should be done to promote and drive more awareness in the use of building adaptability in the design and construction of green buildings in South Africa?

……

……

……

……

……

APPENDIX D- INTERVIEW TRANSCRIPTIONS

CERTIFICATE OF VERACITY

We, hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

NAME OF AUDIO: INTERVIEWEE A

DATE COMPLETED : 26/08/2019

INTERVIEWER: Thank you for allowing me to interview you for this research. As you know, I'm researching the adaptability of green buildings. How easily are they to adapt to changes, future changes and based on your experience, I hope I'm going to get a lot of information. The first question is - my questions are going to be semi-structured, meaning I'm going to be asking you questions that are already pre-determined. Feel free to just speak as much as you can around the questions. My first question is, what is your understanding of adaptability in buildings?

INTERVIEWEE: I'd say my primary understanding of adaptability in buildings is how can a building adapt between different users. So, let's say for argument's sake, you design a building to be an office building, but how is it still possible to maybe in future convert either a part of it or the whole of it for residential or institutional or whatever the case may be, for another use, essentially. So that's my understanding of adaptability.

INTERVIEWER: Okay. Awesome. Are there any examples of projects that you have designed for, or that you were involved on that had elements of building adaptability that you would like to share about?

INTERVIEWEE: I'm trying to recall now. I have worked on similar type of projects, you know the, a couple of projects that I've worked on where office buildings were converted into residential. I've worked on an office building that was converted, during the design stages, so not post-construction, that was converted from an office to a hotel. I've worked on buildings where office buildings designed specifically for cellular offices were converted then for open plan offices, or open plan offices converted into either fully cellular or partial cellular offices.

INTERVIEWER: Okay. How easy was it to do those conversions? Did it involve a lot of demolition for it to be done or was it quick?

INTERVIEWEE: In some instances, it was fairly easy, but it was actually quite difficult. In a lot of cases that did involve a lot of very careful designing and planning. A lot of demolition work, a lot of major interventions to be made on the floor plates to accommodate the new use. Because generally, I think, there is, I'd say 95% of buildings are designed to, maybe these days a bit less so but are designed, essentially, for single use.

INTERVIEWER: Okay. Alright. So, if green buildings are about designing buildings today for more sustainable use in the future, to what extent would you agree that adaptability should be ingrained, should be an ingrained feature of green buildings?

INTERVIEWEE: I fully support that because of these factors that I mentioned previously.

INTERVIEWER: The experience that you had?

INTERVIEWEE: Yes. Because of the amount of design time and effort that goes into it, plus also the demolition and new work that has to happen. That all, apart from adding cost to the project, it's additional man-hours and additional building materials and additional labour. That means a higher carbon footprint and more, you know if you need to build additional features on, that's additional materials also. And if you demolish a building that's building material that were constructed and now all of a sudden are useless. You know, that gets chucked on a building rubble site somewhere. So that's, you know…

INTERVIEWER: Wasteful.

INTERVIEWEE: Yes.

INTERVIEWER: Okay. I understand that you've done green building projects. On the projects that you've been involved in, how was adaptability incorporated in the design and construction of the buildings? Was it incorporated in the design or was it something you had to do when the need arose?
INTERVIEWEE: In some of the instances the adaptability wasn't really a priority.
INTERVIEWER: During the design stage?
INTERVIEWEE: Yes, during the design stage. However, the designs actually ended up being as - well two of the Green Star projects that I worked on, the designs ended up being very flexible in terms of what could -- both were office buildings, the one actually had retail or commercial on the ground floor. But they were designed, there were still a lot of flexibility designed into the design, to cater for flexibility in terms of different tenants. So different tenants might need different office space requirements, more cellular offices, more boardrooms or everything open plan those kinds of things.
So, I think that flexibility that was built into it left not only, like a big open floor plan that gives you, in principle a lot of flexibility, but also built in almost a natural flexibility and adaptability into the floor plates. I wouldn't say that the designs ended up being 100% adaptable for any type of different future use, but there was a good amount of adaptability by default in the designs.
INTERVIEWER: Okay. What are the possible unique design elements that can be incorporated in the construction of green buildings to make them more adaptable and sustainable?
INTERVIEWEE: Well, open floor plates, I think, is one thing. That would mean, you know, it is a tendency that open plan offices are still a tendency these days. That gives you a lot of flexibility in terms of, you know, because there's no additional walls that have to be demolished should you convert the building into, for a different use. Definitely centrally located services because regardless of whether you're building residential, offices, or so, centrally located and efficiently designed and well-coordinated services and service cores always sit central to a design.
If you have services and service shafts scattered all over the place, that might suit a specific building use, but if your building use changes that might have to change completely. So, that I personally feel is very important. And then also, I know it sounds very boring, but basic ceilings and ceiling lay-outs. There's a lot of costs or potential material loss that goes into changes in ceilings when a building's use change.
However, the more uniform your ceiling grid throughout is the better. If you have, I know it's nice to have but the more ceiling features and special ceiling features you have in specific places that, all of that if the building use changes have to be demolished and services re-routed and re-reticulated and all those things. But I think I'd say, probably the most important thing would be, like well thought out, well-coordinated, centrally located, efficiently located and designed services and services cores serving the inside of that building.
INTERVIEWER: And all that can be done during the design stage, before you get to construction?
INTERVIEWEE: Yes.
INTERVIEWER: It's something that is possible?
INTERVIEWEE: Yes, definitely.

INTERVIEWER: To what extent do you think there's a connection between green buildings and building adaptability? Do you see a connection, do they serve each other?
INTERVIEWEE: Yes, definitely. I think, you can be very - if you wanted to, you can be very pessimistic about green building rating tools. Because a lot of clients use it as a tick box exercise just to put this label, this fancy label on the building saying like, look we built and designed a green building. But the reality also is that, you get the different stages or the different types of rating tools. You get the design rating tool, which means that a building is designed and then they submit all the information through the green building council, it gets rated, whatever. It's not to say the building will be built as that.
So that's why you've got a design rating. Then you have an as-built rating. So, if the client wanted to, he can pay the additional money to, after the building has been built to get people in, to go and do tests to see whether the building actually performs as they said during the design stage, it will perform. So, in terms of your energy usage and your actual material, what materials did they actually put in to the buildings. Did they actually use environmentally friendly paints and timber products and those kinds of things.
So, there is definitely a connection, but the connection depends on where exactly do you apply the rating tools. Because building adaptability, the actual effects of building adaptability will only happen after the design stage.
INTERVIEWER: But it must be designed into the construction?
INTERVIEWEE: Yes, so ideally it should be designed into, because otherwise you might not design it into the building and you still get a 4 or a 5-star Green Star rating, but then when your building gets built…
INTERVIEWER: No one comes back to check whether the design was complied.
INTERVIEWEE: Yes. Whether the design is complied. And then if that building changes use, that's when you're actually going to find out whether you've actually designed in proper adaptability.
INTERVIEWER: And that could be years after.
INTERVIEWEE: Yes, that could be years after. So, there's definitely a link, but one will have to link it in, let's say, like both instances almost. And ideally in the design stage. But, like I said, unfortunately there's no control over what actually gets built at the end of the day.
INTERVIEWER: From your own observations, what are the benefits of building adaptability with regards to sustainability of green buildings? Are there any negative drawbacks of building adaptability that become a hindrance to implement in the construction of green buildings? Basically, what are the benefits and are there any disadvantages that you can see regarding green buildings?
INTERVIEWEE: I think the benefit would be is, the benefit would be your future proofing if you do design in adaptability into your buildings, your future proofing, that there won't be unnecessary wastage of material for demolition work, or re-work, or renovation work or whatever, if you do adapt the building later on. So, there is definitely an advantage of designing it in. A disadvantage, I can't think of now, to be honest. I can't think of any disadvantages. I think some clients might see it - let's say, for argument's sake, the Green Building Council of South Africa does bring in adaptability as one of the criteria during the rating system, then there might be some clients who might not like that idea because they want to fit out the building as they want to fit it out. And they're planning to, you know, they

work out their financial feasibilities on a 5 to 10-year lease or whatever the case may be and then after that they're going to sell the building off so they don't care. So, it might irritate clients, but I wouldn't say that that's a disadvantage, necessarily.

INTERVIEWER: Maybe it depends on the use of the building, are you going to rent it, are you going to sell it…?

INTERVIEWEE: Yes, some developers purely develop...

INTERVIEWER: Are you going to live in it.

INTERVIEWEE: Yes, some developers purely develop the building to develop, build it and then sell it and they don't care what happens afterwards. And if they can, you know, obviously, there's probably a slight premium that they can ask for a Green Star rated building. So, they would love to have that block on, that building to say like, 'we're selling you guys a Green Star rated building' but after that they don't care. Or, they develop, they build, they lease out, but they're only planning to lease it out for 5 years or 10 years or 20 years and then after that they don't care.

INTERVIEWER: Okay. Alright, but from your own experience with green buildings, how did building adaptability contribute to the rating system of the green building?

INTERVIEWEE: I don't think it had, like. a direct impact on the adaptability or the fact that adaptability had a direct impact, because there's no real criteria points or scoring points for adaptability. I think there - no, there's nothing specific I can think of. I mean, like, you know, you do get points according to Green Star if you minimise the use of timber products with formaldehyde and PVC products and those kinds of things. So, I guess the less you build the more indirectly it improves your potential rating or scoring, but I don't think there's a direct impact really, currently.

INTERVIEWER: So, building adaptability doesn't really contribute to the rating system?

INTERVIEWEE: Not currently, no.

INTERVIEWER: Okay.

INTERVIEWEE: Not as far as I can think.

INTERVIEWER: Alright. So maybe, the next question follows right up. To what extent are the current environmental assessment rating tools adequate in measuring adaptability in green buildings?

INTERVIEWEE: I have to be honest with you, I cannot recall off hand if there is actually a specific criteria point for adaptability. Because it's been a couple of years since I've worked on a green building, but I can't remember if there is a specific one. I might be wrong, but I can't recall exactly. But it was never, you know, adaptability was - when I worked on these buildings with Green Star Consultants, adaptability was never like a common discussion point.

INTERVIEWER: It didn't add any points, basically.

INTERVIEWEE: No, not that I can remember.

INTERVIEWER: Okay. How much are you aware of factors that drive building adaptability? What is it that can drive building adaptability to make it more, so that people are more aware of it? What drives it, basically?

INTERVIEWEE: I think for building owners, the more adaptable their buildings, the more potential clients they can put in there. I think the more adaptability there is in buildings, there is less that then stands in the way of a client converting a building to a different use.

INTERVIEWER: So, it works for them in the long run.

INTERVIEWEE: It definitely will. There are other factors also at play. Like, for instance, let's say you want to convert an office building into residential or residential into offices or whatever the case might be. The reality is that you'll need to actually go and re-zone the property first, because you can't just take an office block and put in bunch of apartments. You need to re-zone the land that's probably zoned for offices or commercial or mixed use and re-zone it for residential first at the council. So that would be the first step. But then let's say for argument's sake you do get the re-zoning approval; you still have to then physically renovate the building. And if the building was specifically, let's say, renovating to residential from offices, if the building was specifically designed for offices and you have to do so much work inside, so much effort, and re-route so many services and demolish so many things and change so many things and move the lifts and change the lifts and the staircases. If you have to make so many changes, then it's obviously not feasible.

The project will become so expensive for a client it will not be feasible for him to actually do it, to actually do the project after he's re-zoned. So, I definitely think the more adaptable buildings are, the more adaptability you have designed into buildings, that will definitely, I think, that will play a factor with clients, definitely. Especially in South Africa, you know, there's a lot of renovation work more, happening these days, more than new buildings, you know, because our economy is not doing great.

We were at a talk the other day from an international company that does research for, in the property sectors, and they said in South Africa over the last 3 years the vast majority of projects happening throughout the country were brownfield sites. So, it's renovation, alterations, additions, those kinds of things to existing properties. So, I think in those, when you're just building new buildings you can design from scratch, but those buildings will become someone else's building later on or might be converted later on. But within that context of us renovating so much of, so many of the existing buildings, I think it's definitely, it will be a plus point for clients, the more flexible a building's layout is.

INTERVIEWER: Alright. Based on what you've said so far, what can possibly be done to improve awareness of building adaptability, especially with regards to green buildings? What more can be done to build awareness around it?

INTERVIEWEE: Well, I think, it could become criteria as part of Green Star rating tools, for instance. I guess you can probably, maybe if it does become as sort of a building regulation or something of sorts. But the problem with that is, you know, adaptability is - it's not a hard fact or a hard – what's the right word? I don't know what the right word is but it's not something that you can quantify really. So, like for instance, the building regulations tell us how to design stairs and they must be maximum so high, minimum so wide, the stairs and all those things. So that's exact dimensions that you can give to a staircase, saying, like this is exactly. But how do you, in the building regulations, if you have to tell them, like, you want to tell them they have to be adaptable, but what are the physical parameters that you give them. Like, you can't tell them, 'your building must be adaptable between adaptability scale 2 and 10' or something like – do you understand what I mean? Like you can't quantify adaptability. So, I'm not sure exactly how you would do that. I think, to raise awareness, the only other things that you can really do is just, as professional consultants we can advise our clients on adaptability and the benefits of designing their buildings as adaptable as possible.

INTERVIEWER: Okay. But in the industry, the build environment, or construction, how much do you think people are aware of it? Professionals, specifically.
INTERVIEWEE: It's definitely not a big thing.
INTERVIEWER: It's not a big thing?
INTERVIEWEE: No. It's not a common consideration when you're designing buildings.
INTERVIEWER: Even when you're designing green buildings?
INTERVIEWEE: Not generally. Well, green buildings or normal, you know, non-rated buildings. Adaptability is rarely a consideration.
INTERVIEWER: Alright.
INTERVIEWEE: Yes, it's rarely a consideration. But like I said, there are other good design principles like designing your services and your services cores and so on, efficiently and centrally located and those kinds of things. But those are essentially good design principles. So as long as you apply the good design principles then there will be a good accommodation of adaptability in principle. But adaptability on its own, as…
INTERVIEWER: A principle, design principle.
INTERVIEWEE: Yes, no it's not that commonly, a common consideration, no.
INTERVIEWER: So how did you get to know about building adaptability? Was it something that you were taught at university, you came across it at work, colleagues, how did you get to know about it?
INTERVIEWEE: I mean we studied it briefly at university. It was taught to us at university, but we didn't really like go into detail of designing adaptable buildings and so on. But there was certain, you know again, certain design principles that we were taught at university. Stuff like designing your services and your cores efficiently and properly and, you know. There was - it was never addressed directly, I think again, but there was also like something, kind of like unspoken, that the more adaptable and flexible your building is the better your building actually is.
INTERVIEWER: Is there anything you want to add apart from what we have discussed?
INTERVIEWEE: No, not specifically. It would be nice, I personally think, if they could bring an adaptability-criteria in on green buildings. I don't think adaptability will become, in the near future, a big priority item in terms of design criteria or rating criteria for green buildings. Because we've got bigger challenges currently at the moment or the industry sees bigger challenges in terms of energy usage, water saving, you know, those kinds of things.
So, I think that's where a lot of people focus on, because if you're saving energy, you're saving money, plus everybody wants to be kinder to the environment and so on and so on. Adaptability will definitely play a role but I don't think it will be like, one of your top priorities in the near future. That's my personal opinion, in the near future. And also, the other thing that's also becoming a lot more important that a lot of people are realising is your indoor environment quality. That's become, because if you have a nice office, you know, healthy office environment, well lit, natural daylight, and whatever. And it's a nice space to work in and you don't have funny gases everywhere or you use materials that give off gases and stuff like that, and finishes and so on, then people are less sick. So, they come to the office more. So, you know, anyway. But those…
INTERVIEWER: That is the focus of …
INTERVIEWEE: Yes, but I'd like to see adaptability definitely being brought in on... …

INTERVIEWER: The forefront.
INTERVIEWEE: Yes.
INTERVIEWER: Okay.
INTERVIEWEE: Yes. Because like I said, you do see a lot of renovation work happening and you do see in these renovation and alteration and addition jobs that are happening, especially in South Africa, you know you're seeing so much, like you said, demolition happening and changes to be made…
INTERVIEWER: And that demolition does affect the environment at the end of the day.
INTERVIEWEE: Yes. It does, it definitely does. So, it would definitely be nice to - especially I think, you know, because you get the rating tools for different things these days. It'll be important obviously to apply it for new build, the Green Field projects, but I think it should, maybe if you put it into a rating tool, it should carry a much heavier rating, maybe like on existing buildings. If you understand what I mean.
INTERVIEWER: Yes, I understand. Okay.
INTERVIEWEE: Yes, anyway.
INTERVIEWER: Very interesting.
INTERVIEWEE: I hope that made sense.
INTERVIEWER: It does. It answers a lot of questions. Thank you for your time.
INTERVIEWEE: Okay Dudu, you're welcome.
INTERVIEWER: It was nice chatting to you.
INTERVIEWEE: Good luck with your work lying ahead.

CERTIFICATE OF VERACITY

We, hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

NAME OF AUDIO: INTERVIEWEE B

DATE COMPLETED : 27/08/2019

INTERVIEWER: Thank you for allowing me to interview you for this research. My name is Siduduzile Ndiweni and I'm a student at UCT. I'm studying Property Studies. My research is about green buildings and their adaptability to change of use. Thank you for making time for this interview. To start off the interview, can you tell me briefly about yourself and green building experience that you have?

INTERVIEWEE: Okay. I am a trained architect and then I went on to do property development and project management. Right now, I'm running my own company which offers architectural, project management, development planning and green building consultancy.

INTERVIEWER: Awesome, very interesting. From your experience, what is, how do you understand to be building adaptability, what's your understanding of building adaptability?

INTERVIEWEE: For me, building adaptability, for me it means being able to adapt to the new tenant use. To be able to adapt to the new functionality use. Let me give you an example, let's say I was running a warehouse, it's a property that I have and the business is no longer viable and I want to change it to something else. So, I'm looking at the infrastructure to be able to adapt in change of use, that's one of the things that I would point out is adaptability, is it able to adapt with the change in use.

INTERVIEWER: Okay. Are there any projects or work that you've done that have involved building adaptability, so far?

INTERVIEWEE: Yes. I think a lot is going on in Johannesburg CBD right now. Where offices are being converted into residence, for residential use. I think a case in example, which I wasn't part of though, but I just want to give an example so that at least it shed more light, Maboneng Precinct. Those were very business offices, now it's accommodation as well. There are also a number of projects being completed in Joburg, through Johannesburg's Social Housing Company, JOSHCO, into, for residential use. So, I've done one a Home Affairs building. It was being changed from a residential use into an office accommodation. That's in Newtown.

INTERVIEWER: Okay. Would you say that the conversions were easy, was it easy for the buildings to adapt to new use or were there a lot of demolition that happened?

INTERVIEWEE: There were demolitions but not a lot of them. Because now you're just working on the super-structure which is already there and the structural system that was already there. With a clever structural design, you are able to convert because mainly offices these days are open plan. Once you've mapped out what the structural system looks like, you are able to demolish with care. So, I can't say that it was a very difficult exercise. It was something that could be done.

INTERVIEWER: Okay, meaning that the buildings were designed and constructed to be adaptable?

INTERVIEWEE: I wouldn't say so. I wouldn't say so because it was mainly pre-partitioning inside. It was partitioning that you can demolish easily. Like where you have open plan offices right now, yes.

INTERVIEWER: Okay. Green buildings are synonymous with sustainability, you know, when you talk about green buildings the first thing that comes to mind is sustainability. To what extent would you agree that building adaptability should be an ingrained feature of green buildings?

INTERVIEWEE: To a higher degree, I would agree. The reason being, you should be able to easily re-use a building. Reason being, you don't want to end up using a lot of material or more than half the material or introducing new materials to a building. Then it's as good as actually almost building another building. So, adaptability should actually be incorporated into the building. Basically, when someone comes to an architect for construction of any type of infrastructure, the architect should be able to interrogate the brief further and ask how long do you see yourself in business and be able to have a plan afterwards. Of let's say, do you want to decommission the building, how do you do it.

INTERVIEWER: All right. Okay. I'm not sure whether you have been involved in green buildings, maybe during construction or design or planning. If you have, how was adaptability incorporated into the design of the building?

INTERVIEWEE: I can't give a clear answer on that. Because I've only done planning for green buildings, not straight into construction. Ja, but as a design principle, the project that I was working on, the sizing of the spaces was supposed to be able to be in such a way that you can easily change the use of the space to anything that you want. Not restricting yourself to modular sizes which you can't change or specialised uses. Only in areas which require specific type of equipment, like ICT rooms where you put your servers and everything were the ones where you would need to now custom make. But other spaces were office sizes that you can easily change the use into something else.

INTERVIEWER: Okay. What possible unique design features can be incorporated in the construction of green buildings to make them more adaptable and sustainable?

INTERVIEWEE : Unique features?

INTERVIEWER: Yes, like what is it that can be incorporated into the design of green buildings to make them more adaptable? I think it's an extension of the answer that you just gave me. To make them more adaptable and sustainable in the long run.

INTERVIEWEE: I think wider structural system that's not restricted according to the design or the function of that current time. Bigger open plan spaces that you can now allow to be able to remodel them according to the change of use.

INTERVIEWER: Okay. Is there a connection between green buildings and building adaptability? Is there a connection, is there a link between the two? Because the abstract, people talk about green buildings and there's a concept of building adaptability, but do those two concepts come together, is there a connection between the two?

INTERVIEWEE: I would say adaptability is encompassed in green building.

INTERVIEWER: Is encompassed, or should be encompassed?

INTERVIEWEE: Is.

INTERVIEWER: Is?

INTERVIEWEE: Encompassed, because according to the studies here in South Africa, it's one of the modules that you actually have to study about. It's not a separate item, it's something that's actually included. Once you can prove that the building can actually be converted into some other use, there should be, there are credits that you're awarded for that.

INTERVIEWER: Okay. From your experience and knowledge, are there any benefits, merits of building adaptability regarding green buildings or any disadvantages that you can think of? Benefits and disadvantages of building adaptability regarding green buildings?

INTERVIEWEE: The benefit, obviously, is you can change it according to whoever the tenant is going to be. But the drawback might be, which is to a very lesser extent, it might be expensive. The capital investment that you have to put to actually have a building that can be changed into anything else might be too much for certain specific clients.
INTERVIEWER: All right. What could be those, the type of clients that could see it as a drawback?
INTERVIEWEE: Let's say clinics. Clinics are a specialised function. Imagine trying to change a clinic into some other use. It comes with a whole lot of equipment that needs to be specialised in terms of how you service them, how you accommodate them. Such kind of buildings, they are highly specialised. And once you go that route, you can achieve it, but obviously it will come at a...
INTERVIEWER: At a cost.
INTERVIEWEE: ...higher cost, yes.
INTERVIEWER: Okay. I understand that. Does building adaptability contribute in any way to the rating of green buildings? If it does, how does it contribute? Is it part of the criteria that is considered for a building to be rated as green?
INTERVIEWEE: Yes. It's part of the criteria. So, you actually get points by being able to design in such a way that there is change in use.
INTERVIEWER: Okay. All right.
INTERVIEWEE: So, you gain points.
INTERVIEWER: Okay. So, it is a criteria that is considered?
INTERVIEWEE: Yes, definitely.
INTERVIEWER: Okay. Is it a criteria that is considered during design and even at construction stage?
INTERVIEWEE: I don't know what your understanding of green building is, but let me just explain a bit for you. There are two types of accreditations that you get. The first accreditation is design, which is when you can be given a 5-star rating for design.
INTERVIEWER: Based on a design only?
INTERVIEWEE: Based on a design. Then you might decide as a client or as a developer to go ahead and claim the same credits during your construction. Which is, for me, what green building should be about, the as-built accreditation. Because now they measure your performance against what your plans were. Once you pass that then it means your building complies with what your design intent was. There's also a continual measurement to make sure that your building is always complying. So, there is.
INTERVIEWER: Are there cases where architects would submit drawings and they are assessed and then when you get to construction the design has changed in such a way that it doesn't comply to what the design was before?
INTERVIEWEE: That's very possible. Because to actually go down the path of green building assessment or green building, achieving green building rating status, it's capital intensive from the materials that you have to use. The skill that you have to use and the management of the project on site. And anything can be changed, if you're in that process, which impacts the achievement of the rating. So, it's very possible that you might not achieve the same credits that you achieved, that you actually got during design.

INTERVIEWER: Okay. All right. To what extent are the current environment assessment rating tools adequate in measuring adaptability in commercial green buildings?
INTERVIEWEE: To a large extent they are developed and finalised. There are only, I think, two categories which are still not really finalised. But those are the ones that people can actually change according to the context they are working in. But issues like adaptability, they've already been catered for. Once you want to claim points based on adaptability, there's a criteria in the framework that you can use to claim those points.
INTERVIEWER: Okay, so they are adequate?
INTERVIEWEE: They are adequate. There's always obviously, additional points that you can claim through innovation. Which means, if your adaptability or adaption initiatives are actually not catered for, you can actually introduce new ones and then you claim them under innovation, so you score the points.
INTERVIEWER: Okay, interesting. What are the possible factors that drive building adaptability? Like, what makes building adaptability an option? What is it that causes, like you as an architect, what is it that will make you want to design a building that is adaptable? What are the forces that will drive you to take that option?
INTERVIEWEE: It makes the building timeless. What it means is that if I'm the developer or owner of the property, I'm not going to be limited to certain specific clients or tenants. My building can be used by quite a number of people, which means that my building is timeless. That's the driver for me other than all the other sustainability issues which are in there, such as retraction of changes of materials and all that. But the highest, what I would say, is for me not to be restricted to one specialised function of the building.
INTERVIEWER: Okay. All right. How much is the awareness of building adaptability in the industry that you are in? How much do people know about it, the professionals, the developers, know about the concepts of building adaptability?
INTERVIEWEE: I think it's something that has always been there. It just now depends on how 'professional' designers will be. I think it's something that even yourself when you're buying a house, you bought a house, you might have bought a house that was designed by someone else. The easier for you to settle in that house is a benefit rather than going into a customised house or office space. That's why most of offices are planned using the floor plans in the structural system only without too much partitioning or restrictive partitioning inside. It's something that has been used in many traditional methods before the introduction of green building.
INTERVIEWER: Okay. So, you'd say that there is a lot of awareness around it in the built environment, or construction industry?
INTERVIEWEE: Yes, it's just that some people choose to ignore it.
INTERVIEWER: Is it?
INTERVIEWEE: Yes. It's just that some people choose to ignore it.
INTERVIEWER: How did you get to know about building adaptability, especially regarding green buildings? Is it something that you were taught at school, you came across it at work, or …?
INTERVIEWEE: The sustainability courses are embedded in the studies of architecture. So, from that, the seed is planted.

INTERVIEWER: All right. What can be possibly done to improve the awareness around building adaptability with regards to green buildings? What more can be done to improve awareness, so that all green buildings are adaptable?
INTERVIEWEE: All green buildings or all buildings?
INTERVIEWER: All buildings, but my focus on this research is basically on green buildings.
INTERVIEWEE: I think that it has already been catered for through the green building initiative itself. It caters for adaptability. So that has already been done. I would say, if you want to take it a step further now, enforce it through by-laws, building by-laws. Because building by-laws, they are statutory. Your national building regulations, they are statutory. You can decide not to have a green building but you can't decide not to follow national building regulations. Once they take those tools and put them onto the national building by-law regulations, then every designer is actually forced to be able to comply.
INTERVIEWER: Yes, okay. Makes sense. Is there anything else that you'd want to say, add, on top of what we have discussed?
INTERVIEWEE: No.
INTERVIEWER: Okay. Thank you for making time for this interview. I think it was fruitful and insightful. Thank you for your expert knowledge.

CERTIFICATE OF VERACITY

We, hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

NAME OF AUDIO: INTERVIEWEE C

DATE COMPLETED : 27/08/2019

INTERVIEWER: Thank you for making time for this interview. For giving me an opportunity to interview you. My name is Siduduzile Ndiweni and I'm a student at UCT. I am doing Property Studies and part of my dissertation I am doing a research on green buildings and their adaptability. Would you mind to tell us a little bit about yourself and your experience on green building? What is it that you do and your contribution to green building?
INTERVIEWEE: I am a modelling and simulation consultant here a Solid Green Consulting. What we, what I mainly do is the modelling and energy credits for various buildings to try and get them to the green star level and lead and any other registration that is required.
INTERVIEWER: We've got two other members joining the interview, you can introduce yourselves.
INTERVIEWEE: I am a green building consultant here at Solid Green. I started about a year and a half ago. My role is getting buildings to be accredited. So, we submit to the Green Building Council and where help project teams, advise project teams on how they can put in initiatives to make their buildings sustainable and submit those initiatives to the Green Building Council. The Green Building Council who gives the final rating, we don't give the final rating. But we assist with that rating process.
INTERVIEWER: All right. And?
INTERVIEWEE: Cool, so my name is Jeffery. I do the same thing Alex does. So, I'm also a modelling and simulations consultant. So, we, as I said we work with energy credits but we also do modelling to look at how efficient a building is running and you make it more efficient. That kind of stuff. So, yes, basically energy.
INTERVIEWER: I just said my research s centred around green buildings and how adaptable they are to change. So, I would like to find out how much understanding do you have of building adaptability? What do you understand about that term?
INTERVIEWEE: From what you have...?
INTERVIEWER: I mean, from your own experience at work or, your understanding of term building adaptability.
INTERVIEWEE: Okay, so...
INTERVIEWER: Have you encountered that terminology at work?
INTERVIEWEE: No.
INTERVIEWER: Is it the first time that you're hear this...?
INTERVIEWEE: That term that a building is adaptable?
INTERVIEWER: Yes. Okay.
INTERVIEWEE: And also, how you described it, It's like the change of use. So, we haven't dealt with a project like that is currently changing it's just the use from something to something else. If that's makes sense?
INTERVIEWER: Yes.
INTERVIEWEE: So, I am not familiar with that. I don't know if the boys are.
INTERVIEWEE: JA, no, we've just been involved on new buildings, so we haven't got to the stage where we've changed basically existing buildings. And I've got Newtown but even usually also like a refurbishment. They don't change from an office to suddenly a hospital...
INTERVIEWEE: We do work, there are some existing building projects that we've worked on as Solid Green but the use isn't changing.
INTERVIEWER: So, you haven't really encountered...

INTERVIEWEE: No.
INTERVIEWER: ...a building that had to change use?
INTERVIEWEE: No.
INTERVIEWEE: Yes, t like an office will still be an office. t just might be a better performing office but it's still the same...
INTERVIEWEE: Yes, the uses remain the same.
INTERVIEWEE: We did a lot of buildings and that's on line that's never been touched before
INTERVIEWER: Okay, all right. During the process of accreditation, does the design of a building get to be evaluated also? Does it get points?
INTERVIEWEE: You're the best one.
INTERVIEWEE: How it works is, in the accreditation process, so the Green Building Council has many ways to accredit you building, right. There's Green Star, there's Lead, there's Edge, there's Zero. So with Green Star, there is two ways that you can accredit it. You can accredit the design of the building or you can accredit the as-built layout of the building, so after construction. The design, so when you look at the design rating of a building, that's exactly what you're evaluating. You're evaluating its design phases. You're evaluating what the architects has designed or what the mechanical, electrical with services, right, the initial designs of the project.
And all the documentation that you submit to GBCSA, is based on those designs. So, they're evaluating those designs. It's only in as-builts where you're not considering the design anymore. It's currently as it stands, can it get the points, to be a four star or five star or six-star building. Do that make sense?
INTERVIEWER: Yes, it does. So, the rating that the building gets for its design, does it contribute to the overall rating of the building, sort of like? If you say a building is four star, does it also include the rating from the design or is the rating for the as-built?
INTERVIEWEE: Okay, so you can choose. If a client wants to get four-star design rating, then we only evaluate the design documentation and they get a four-star design rating. That's the overall. If you want both then you get, the client must say I want to get a rating for design and as-built. It's going to be one plaque on your design and then a separate plaque for your as-built.
INTERVIEWER: So, it's two processes?
INTERVIEWEE: It's two different processes.
INTERVIEWER: Okay. All right. Building adaptability is a design principle, its applied during the design, you know. Do you think that Building Adaptability is a concept that is one of the rating criteria for assessing the design of green buildings? Would you think that it would be accredited? Like, is it be assessed, can it be assessed if it's incorporated in the design?
INTERVIEWEE: It's like future proofing but it's not so much, its changeability is the main thing. It's not really...
INTERVIEWER: You allow elements in your design for that change to happen later on. So my question is...
INTERVIEWEE: What kind of elements?
INTERVIEWER: I'm not an architect but it could be maybe having this, the ceiling higher than this.
INTERVIEWEE: It doesn't get...

INTERVIEWER: Or making demountable walls that you can remove later on. Can that be assessed as part of something that contributes towards the greenness of the building during the design?
INTERVIEWEE: No. It's currently not assessed.
INTERVIEWER: Currently, no.
INTERVIEWEE: For in green sites monitors. For in EDGE it is assessed. Because it's like you have this sort of like aging residential rating tool. So, if we put on the tool that we don't have air conditioning, the software calculates something called virtual energy, say, how much energy is required if there was air conditioning. So those type of, in age it's more like an energy thing but if you were to put it how much would the building use. If that answers your question?
INTERVIEWEE: Then I guess, if you're doing an EDGE home without air-con and you consider when it does have air-con if it does change into an office, EDGE account for it.
INTERVIEWEE: Yes, I think...
INTERVIEWEE: But the change of use is…
INTERVIEWEE: We don't use that word.
INTERVIEWEE: Ja, no...
INTERVIEWEE: We don't say change of...
INTERVIEWEE: It's a bit difficult to…
INTERVIEWEE: Yes.
INTERVIEWEE: I mean, an office might be a refurbished office in the end but not a, no, we haven't dealt with adaptability at the moment.
INTERVIEWER: So basically, Building Adaptability is not something that you consider when you are evaluating for…?
INTERVIEWEE: Not currently.
INTERVIEWEE: Not in that term. Mostly what we are looking at is the resilience of the building to...
INTERVIEWER: The resilience?
INTERVIEWEE: Yes. So, it's the current environmental conditions. Can this building last and not, and not harm the environment? I think that's the main purpose of a green building. It would be interesting to see, I mean, it's interesting because there's many office buildings now, I guess. But what is the background of your research? Like what is your problem statement?
INTERVIEWER: The office, commercial green buildings. Like office buildings that's where I'm looking at.
INTERVIEWEE: So, what is the problem that you're wanting to research on?
INTERVIEWER: Basically, I'm saying that Building Adaptability is something that helps with the sustainability of the environment. Because if a building is adaptable then there is less demolishing, which affects the environment in a positive way. And then on the other hand green buildings are sustainable. They are supposed to save the environment. My question is, if we are going to build structures that are green but that are not adaptable to a different use. In future what will happen if the use changes, are we going put down those buildings, are we going to demolish, what are we going to do?
If we are going to demolish, are we not going to be affecting the environment that we are trying to protect? That's the angle that I'm coming at. I'm trying to evaluate; you guys you

do assessment for green buildings. So, I'm trying to find out, do you evaluate for Building Adaptability in your assessment? Is it something that is considered?
INTERVIEWEE: No.
INTERVIEWEE: You don't get any points, no.
INTERVIEWER: So that we can make recommendations to future policies?
INTERVIEWEE: No. I think, so if your angle is looking at, we have to demolishing to, I mean, we have to, like is demolishing contributing negatively to the environment. There are ways in green star, I'm not sure about EDGE or Limit Zero, where there's initiatives that we can sustainably manage the demolition and refurbishing process.
You look at the recycling of that demolishing waste, construction waste. We look at the products being used in the reconstruction, were they from a recycled content? We look at the ISO certificates of the contractor. There is ways where we can, we're looking at the practices of demolition in construction but not avoiding it.
INTERVIEWEE: Our job as consultants in this case because what accredit green buildings, Like, you know, they'll say I want a green star rating. So green star in itself would have two points and say this is what the points, this is what should be done for it to get a green building. We won't then, I mean, if it's not part of that tool to say we should adapt for different use, we won't then consultant say, you know, skew building. We don't, we won't do that because it's not part of the criteria that set by the tool. If the tool sets different criteria then we will join, vice versa.
INTERVIEWEE: And even if they are to change that use and, so you want to change that use and still want to be a sustainable building. If you have an office and you want it now to be a residential building. You'd have to say you want to have a sustainable residential building and then that can give you one and tell you how can you have a sustainable residential building. You just have to make sure that the uses in their changes remains sustainable. If that make sense.
INTERVIEWER: Yes, it does. It leads to the next question. Do you think that the current environment assessment rating tools are adequate to measure Building Adaptability? Do you think there, are they adequate?
INTERVIEWEE: No, I...
INTERVIEWEE: We don't, it's not even a thing that's looked at.
INTERVIEWEE: Like we don't even account for it in any way. But I think it's pretty interesting.
INTERVIEWEE: Yes, it is interesting.
INTERVIEWEE: Like if, especially I think if you're going into office dense environments and now you need more people. People need to stay there right? When you need to now change those buildings to residential, can you building, I think it's very interesting. But we don't account for that now. EDGE, but like Alex said.
INTERVIEWEE: Just for that one thing it accounts but then that's about it. I mean, if we demolish a high-rise office now in Sandton, like the amount of glazing that just comes off there, can you really re-use it or can you really do anything with it? It's a big question. Like, it's just like glass everywhere if you noticed? If it was an office and it was something else, which all that glass would go to waste.

INTERVIEWER: In your own opinion do you think that Building Adaptability can enhance long-term sustainability of green buildings? From how you understand Building Adaptability now, do you think it can enhance long-term sustainability of green buildings?
INTERVIEWEE: I think so.
INTERVIEWEE: If you are re-using a building, I think that it could help. And in terms, I mean, you look at factors like you don't want to use open space. You're using the same space, so I think it will.
INTERVIEWEE: But also, it's, I think, mainly to consider, I think interiors, like interior refurbishments look at sustainability within an existing structure. But I guess...
INTERVIEWEE: Because interiors look at, does it change really from like office to residential.
INTERVIEWEE: It doesn't.
INTERVIEWEE: It doesn't. Then so long as it's still an office block.
INTERVIEWEE: Ja, or if it's a gym you 'd look at interiors, yes.
INTERVIEWEE: Interiors.
INTERVIEWER: Ja. I guess it may help. So, I don't know what I was saying but what I meant to say is, I do think so. I think if we consider from the beginning that you use a glass that can be used in every land use and don't have to take that out when it's residential and it's office. I think it's…
INTERVIEWEE: I think it's only applicable like in less densely building areas. Like if we're in Jo'burg you have one building, one purpose. If we are maybe just outside Bloemfontein, you know, we have open land everywhere. What was an office could be converted into a gym or could be converted. But in Joburg what's an office it's an office, I mean, it's not going to change too drastically there. People would also, anyone who develop it there, they take that twenty-year leases before, it's going to change maybe, in the next forty years. Even then the next tenant will come and do his own thing.
INTERVIEWEE: Stuff to consider.
INTERVIEWEE: I think also just the basic criteria for whether it's an office or a hospital, I mean, the tools that you will use. Everything is going to be very different in terms of general criteria. You would have to consider, like those codes will have to change first before you can say that you'd have to, and the government will say, sharp, tick the box you can build.
But from a government level it would be like, you know, you don't need the specs, you build for an office, you don't need the specs for a hospital. There's nothing we can do to say. Yes, I think it's, I don't know.
INTERVIEWER: But do you think that there is a link, there is a connection between Building Adaptability and sustainability of green buildings? Is there a link, is there something that brings those two together?
INTERVIEWEE: I think there possibly is one if you identify what are the issue? Like what is, what needs to be changed in adaptability. We look at demolition. What else? Like what exactly about the change of use would make it unsustainable?
INTERVIEWER: The fact that you are going to demolish and you are going to waste materials and then you're going to affect the environment. Like when they're demolishing there is pollution, there is noise, all those things are affecting the environment that we are trying to protect by building green buildings.

So, the question is, is there is a connection, should we bring these two things together? Because apparently, I think, they're not existing together, they are two separate things. Green buildings on one side, there's Building Adaptability on the other side but can these two concepts come together to serve a purpose? That's where I'm coming from.

INTERVIEWEE: I think if you're only going to look at demolition, there is a way where you can make demolition and construction sustainable. And that's not something that the original owner of the building needs to consider, it's [inaudible 00.17.59] change the use needs to consider. He says I want to greenify my new use from demolition states, then you can greenify it.

INTERVIEWER: Do you see a link between those two concepts? green buildings and Building Adaptability, or are you not sure?

INTERVIEWEE: I'm not sure.

INTERVIEWEE: I mean if it were, I guess it depends what initial principles were starting with, ja. If looking at a green building in terms of the least impact onto the environment. That building would probably fit into that category, like a bigger picture.

INTERVIEWEE: I think maybe it's important to identify the issues with that change of use that are making it unsustainable. More than just the demolition and construction process, because that's already been addressed in green buildings. So its needs to be something else that is a problem to sustainability on why changing of use needs to be sustainably managed.

INTERVIEWER: The thing about Building Adaptability is that you make those allowances in the design. So that when in the event that there is a change of use, the changes are not drastic. There's not a lot of demolitions. It's something that is embedded in the design.

INTERVIEWEE: Okay, so change design.

INTERVIEWER: It's not something that you do because now you see the need, it's already there. That's where…

INTERVIEWEE: I think that's something, so I think the architects could identify exactly what needs to be implemented in a building so it can be adaptable to many uses. Then from there, you see how we can make those changes sustainable.

INTERVIEWER: From there that's where you guys you must come. Because now if they allow it on to the design, do they get points, does the building get points for that?

INTERVIEWEE: No, they don't.

INTERVIEWER: That's where my decision comes in.

INTERVIEWEE: It's not design.

INTERVIEWEE: No, points.

INTERVIEWEE: No, points.

INTERVIEWER: Because if they're not going to get points then there is no incentive to do it?

INTERVIEWEE: There's no points.

INTERVIEWER: No points for that?

INTERVIEWEE: No.

INTERVIEWER: Okay. All right.

INTERVIEWEE: Not with that.

INTERVIEWER: I think you kind of answered but I will ask you this question. How much awareness is there in the industry about Building Adaptability? Especially concerning the

green buildings? How much awareness is there within the professionals, the stakeholders, people that are involved in the construction of green buildings?
INTERVIEWEE: Of Building Adaptability?
INTERVIEWER: Yes.
INTERVIEWEE: How much? I haven't, I've never had a conversation about. It's never been discussed in a meeting…
INTERVIEWEE: Yes, certain spaces in a building haven't been decided. They, they sort of like work towards that.
INTERVIEWEE: Maybe it can be retail.
INTERVIEWEE: Then also, okay, this is an open space we could use it for a boardroom or we could use it for...
INTERVIEWEE: Retail.
INTERVIEWEE: Retail or whatever. But we, you know, that design sort of like accounts for the room but it doesn't account for anything else. There won't be specific things to that.
INTERVIEWEE: Like they won't build an office in keeping in mind that this might change into something else…
INTERVIEWEE: Ja. So, it's just full office design and then if they use it for something else, they use it for something else. They're not going to go back and we don't or Green Building Council doesn't award any points for that.
INTERVIEWER: Okay, no.
INTERVIEWEE: I've never, you can look at WELL...
INTERVIEWEE: and LBC.
INTERVIEWEE: it's another accreditation system, and LBC.
INTERVIEWER: But I'm more, I'm more on the green star.
INTERVIEWEE: You want only...
INTERVIEWEE: You only want green star?
INTERVIEWER: Ja.
INTERVIEWEE: Okay, oh, I...
INTERVIEWER: So, would you say that there's a lot of awareness, there isn't?
INTERVIEWEE: From my side I have never seen that.
INTERVIEWER: All right. What do you think...?
INTERVIEWEE: I think maybe it would be interesting because I know COJ wants to change a lot of their current buildings to offices and mixed use. It would be interesting to see from someone that's working in the public sector right now how they see that coming, the only office building in CBD of Joburg. All line like flats now they want to make it mixed-use, retail, people, ...
INTERVIEWER: How are they going to do that?
INTERVIEWEE: So, see how that, it's going to be an interesting person to talk to. Something COJ.
INTERVIEWER: Okay. Seeing that there's not a lot of awareness around this subject, what do you think can be done to improve it?
INTERVIEWEE: To raise awareness?
INTERVIEWER: Yes, to raise awareness.
INTERVIEWEE: Incentivise it.

INTERVIEWEE: Then... That is the easy way.
INTERVIEWEE: It's the main thing. Give people a reason to do it.
INTERVIEWER: How can you give...?
INTERVIEWEE: Maybe the Council, maybe the Council should look at, like changing their, adding it int their system of accreditation in some way…
INTERVIEWER: The Council you mean the green building council?
INTERVIEWEE: Green Building Council, yes.
INTERVIEWEE: Also, maybe get banks involved. Maybe get a...
INTERVIEWEE: Tax incentive.
INTERVIEWEE: Yes, tax incentive or a loan back, you know, a percentage of …
INTERVIEWER: You mean like when the companies wanting to...
INTERVIEWEE: Take a loan, ja. Then, it's sort of like work backwards...
INTERVIEWEE: If there was an assessment that this building is not, can't be used for different things. You don't get your full loan.
INTERVIEWEE: Like you get like I said...
INTERVIEWEE: You get like thirty percent of your loan required. I think that's also another way. Anything that deals with the money. Because a client is not going to do if he doesn't get the payback. If you can increase their profits. So, you may look at how, what...
INTERVIEWEE: Because their profits will decrease. .ja, increase their profits.
INTERVIEWEE: Anything that's increasing their profit, they will do it.
INTERVIEWER: Okay. Is there anything you want to say, over and above what you have discussed around the topic of green buildings and Building Adaptability?
INTERVIEWEE: No.
INTERVIEWER: Okay.
INTERVIEWEE: Good luck.
INTERVIEWER: Thank you, Noma and Alex for giving me this opportunity, your input are going to be valuable on my research.

CERTIFICATE OF VERACITY

We, hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

NAME OF AUDIO: INTERVIEWEE D

DATE COMPLETED : 28/08/19

INTERVIEWER: Thank you for making time for this interview. My name is Siduduzile Ndiweni in short you can call me Dudu. I'm a student at UCT. I'm doing a Master's Degree in Property Studies. As part of my research I'm doing a thesis on green buildings. But my angle is around adaptability. I'm trying to find out whether green buildings are designed and constructed in such a way that they respond to change of use over time.
INTERVIEWEE: Change of use over time?
INTERVIEWER: Yes. So that is my angle.
INTERVIEWEE: Okay. No, good.
INTERVIEWER: I would you to introduce yourself and tell us a little bit about yourself and the work that you do around the Green Building Council and around green buildings?
INTERVIEWEE: I am an associate in the building's unit of Aurecon. I've been in the company for 12 years but since 2011 my Director and I started the sustainability team for Aurecon. We basically started with the very first project which we did for Hyundai automotive, their head office in Bedfordview.
We grew the expertise and the number of team members following that project to what we are currently. Our team in Aurecon is probably one of the, not probably but it is one of the biggest teams in the country and a project team that has done most of the projects in the South African context, along couple of other big consultancy firms that are operating in our industry.
INTERVIEWER: My method of doing research is a case study, so I want us to discuss one project that you are comfortable with that you have done or that you are doing, that we can focus on, just one project.
INTERVIEWEE: Okay. Well, let's talk about the Discovery project because the Discovery head office in Sandton, this is one of my very recent, very recent projects that I've worked on. And...
INTERVIEWER: What is it called?
INTERVIEWEE: Discovery, Discovery head office in Sandton.
INTERVIEWER: So, the role that you play as the company, are you involved in the design of the building or you're more of a green building consulting company?
INTERVIEWEE: We, I mean, for that particular project Aurecon provided an environmentally sustainable design. All green building consulting services as well as mechanical services. So, we were involved on both these fronts. Usually we propose to our clients these two services hand in hand, because as you know mechanical services is the largest energy use in the building. From that point of view, it works very well to provide environmentally sustainable design because, together with mechanical services, because we are working together as a team.
We're providing the modelling for the building that is required for certification of the building under the green star local scheme. It's just, we are trying to implement energy efficiency strategies and it's kind of working well to do the design together with our colleagues, who are responsible then for mechanical services.
INTERVIEWER: So, you are involved in the design but on the mechanical engineering side.
INTERVIEWEE: Yes, but strictly I, I work on the green building consulting team.
INTERVIEWER: So, I will not ask design questions from you first.
INTERVIEWEE: You don't have to; what we do is we influence design from a green star point of view. We are the influencers. We implement initiatives within the design of the building.

We work together with the other consultants that's the architects and the whole professional team to basically inform them and to implement sustainable strategies within their design. That is our role basically. We don't design but we influence the design.

INTERVIEWER: Awesome. What is your understanding of building adaptability? Is it something that you have encountered that in your line of work or it's a new terminology?

INTERVIEWEE: Well, building adaptability is relatively a new strategy of designing, I think. I mean, if we consider how long green buildings have been on the market, how much green buildings are in the market in comparison with adaptability, I would say that adaptability probably is a newer term than sustainable buildings, specifically for the South African market. What I can say from defining green buildings in principle, is that you cannot look at the two terms completely in isolation.

Because intrinsically a green building is supposed to be an adaptable building. There is definitely design strategies that are implemented in green buildings which contribute towards the adaptability of the building. But the important thing here is to define adaptability, because the building, the building's interior could be adaptable but the building's exterior could also be adaptable. We need to understand how do we define exactly adaptability. When, you probably will ask me more questions, so maybe I should stop and let me answer one by one the questions because I'm going to repeat myself otherwise.

INTERVIEWER: The project that we are discussing today, Discovery head office in Sandton, do you think that it was designed to be adaptable? Were there any adaptability principles that were incorporated in the design?

INTERVIEWEE: Definitely. Primarily within the interior, within the interior of the building we know that business is changing much faster these days. We know that tenants' requirements change as well. So, when the building was designed specifically flexibility within the interior space design was important, of importance to the, both to the interior and the main architect. So that the spaces are designed in a way that you can quickly shuffle them or re-purpose the use of those places as and when required.

You know, the Discovery building is one of the biggest office buildings in South Africa. Specific care was taken to design all the spaces so that they are conducive to the requirements of the occupants. One of the newer principles in designing indoor spaces of buildings is that of providing flexibility. But also, the design should be conducive to the well-being of the people in the building. That requires different areas in the office environment to serve different purpose.

For instance, some people require a bit more private areas to work. Some people require open areas that they bring the teams together and they discuss issues as a team. Whereas in the private areas people want to concentrate to be more focussed. So, the building was designed in such a way that it provides various areas for people's needs, for the occupants need within the building.

INTERVIEWER: Building adaptability is a design principle or a concept that is usually embedded within the design.

INTERVIEWEE: In the design, that's correct.

INTERVIEWER: Yes. Are you involved in the accreditation of green buildings? Like, were you involved in this project?

INTERVIEWEE: Yes.

INTERVIEWER: Is the design of a building assessed towards getting points for…
INTERVIEWEE: Yes. Well, as I mentioned, specifically the interior of the building was designed to be very adaptable. The building is also pursuing, apart from the base building design and as-built rating, the building is pursuing an interiors rating as well. And the interior scheme specifically addresses adaptability of interiors in terms of changes and in terms of the function of the tenant. So, yes, definitely. Green star interior certification scheme definitely looks for interior designs that are adaptable amongst others such as being sustainable, for instance.
INTERVIEWER: All right. Was building adaptability one of the criteria that were assessed for the sustainability of that building? The design of that building was it assessed?
INTERVIEWEE: Yes.
INTERVIEWER: Was, what I'm saying is, green building adaptability, was it one of the criteria that was looked at to assess…
INTERVIEWEE: Yes.
INTERVIEWER: It was?
INTERVIEWEE: Yes, absolutely. It is a requirement. There is a requirement of the interior scheme for buildings, for interior flexibility, adaptability. The interior to be aligned with the function of the tenant. Which means that if the tenant functionality changes, if the tenant requires anything else in future, that the area of the buildings within, you know, within, inside that could be changed as well. Yes, definitely the design was aligned with the requirements of the green star scheme.
INTERVIEWER: When they say a building has got five green star, are they referring to the as-built, the building when it's complete or the design? Are those two evaluated differently or it's one component? I mean the design and the actual completed...
INTERVIEWEE: There are various schemes. The Green Building Council has a number of different schemes that evaluates the environmental performance of a building. And if you look at new construction, the first scheme that projects usually target, that's the design certification. So, if you hear people saying five-star design certification, that means that the design of the building is certified under the particular scheme.
If it's an as-built certification, that then means that the as-built status of the building has been certified. And as you're working in our industry you would know what is the difference between design and as-built. I'm just trying to explain that they are two different certifications. Then, I spoke earlier about interior certification, interior certification is only applied to the interior of the building. That comes after the building is constructed, where we've got a specific tenant fit out, which then is designed. The fit out itself is designed in line with the green star certification principles.
INTERVIEWER: In general, would you say that the current environment assessment rating tools used in South Africa are adequate to measure...
INTERVIEWEE: Adaptability?
INTERVIEWER: Yes, of green buildings.
INTERVIEWEE: No, I don't think so. You know, the tools were specifically designed to measure environmental performance of buildings. You can look at adaptability of the building from an environmental performance of the building as well. Because the more adaptable the

building is, the less resources and the less negative effect you've got on the environment. So intrinsically, as I said earlier, sustainable buildings should be adaptable buildings as well.
But the schemes, per se, do not have a specific requirement for adaptability at large to be implemented in design. But sustainability on the other side is also to do with adaptability. To my mind you cannot differentiate between adaptability and sustainability. When you design a green building, you will be thinking in line of adaptability as well. So, definitely.
INTERVIEWER: When the Discovery head office project was designed, what were you anticipating? How was adaptability anticipated to enhance sustainability of that building in the long run? Like when we're having those principles of adaptability in the design? What was the, what were you foreseeing how was it supposed to, how are you supposed to enhance the sustainability?
INTERVIEWEE: The sustainability of the building?
INTERVIEWER: Yes, how is adaptability enhancing the sustainability of that building?
INTERVIEWEE: Well again, when I spoke about the interiors of the building that is so flexible and so responsive to the tenants use, this is definitely contributing towards the sustainable performance of the building as well because you can think about it. If the building doesn't respond to the user requirements, the user will have to be forced either to go to another building. Construct something else or even construct something different and abandon the old area that they've had in their own building.
So, by implementing flexible design this is definitely contributing towards the sustainability of the building. Because you would use less materials to fix a new fit out within the building. You, with less effort, with less materials you will be able to respond to the needs of the tenants. So, definitely, there is definitely a positive connection between adaptability and sustainability.
INTERVIEWER: You've just answered the question that I wanted to ask to say to what extent do you think is there's a connection between adaptability and sustainability of green buildings?
INTERVIEWEE: When you speak about adaptability, I mean, how do you define it? I mean, have you got study material that discusses adaptability? When you speak about adaptability do you consider interiors, do you consider exteriors? Is adaptability related to climate change? How do you learn about adaptability in your study course?
INTERVIEWER: Adaptability is about the ability of a building to respond to...
INTERVIEWEE: Changes.
INTERVIEWER: ...a change of use.
INTERVIEWEE: Change of use? Okay.
INTERVIEWER: My question is that ability of a building to respond to change of use, is there a connection? Does it connect in any way with sustainability principles of green building?
INTERVIEWEE: Yes. Look, if we speak about office buildings, strictly about office buildings, you know, they are constructed as offices but you would see that in the inner city of Joburg, for instance, a lot of the office buildings are currently being, old office buildings, are currently being converted to residential type of buildings. You know, the old office buildings were not green buildings, they were just conventional office spaces. Yet they are currently being converted into office space.

Strictly speaking an office building that is designed could be converted into something else, but it all depends on the demand of the market and on the requirements of the developer. And if this building seizes to be occupied as an office, then one would have to re-purpose it as something else. The Discovery building is a big office building, is a big corporate building. I think that they are more difficult to be converted into something else once they are designed as big office buildings.

But if you look at smaller buildings, more kind of normal size buildings, when I said the Discovery building is a big building, its 150,000 square metres. It's a massive, massive building. Whereas if you look at the normal commercial office building, say of between 10,000 and 15,000 square metres, you will be able to convert that more easily into something else than the large buildings that are constructed around here.

INTERVIEWER: So, that Discovery office building, what star did it get in terms of...?

INTERVIEWEE: It achieved a five-star design rating. It will be targeting an as-built rating as well and we're currently preparing the documentation.

INTERVIEWER: Okay. And building adaptability, was it considered there, was it a part of the assessment on the five-star?

INTERVIEWEE: It was part of the assessment in as much as you can relate adaptability to sustainability. We didn't have a system for adaptability under which we can certify...

INTERVIEWER: There's no specific tool that speaks to adaptability.

INTERVIEWEE: Exactly.

INTERVIEWER: Is that what you're saying?

INTERVIEWEE: Yes, exactly, that's exactly what I'm saying. We have a sustainability tool or a green building tool that measures the environmental performance of a building. With that tool we certify buildings for their environmental performance. But as I explained earlier, I cannot look differently to a building that is sustainable not being also adaptable, you know. They have to be adaptable as well. Except there is no defined tool or defined specifications and definitions. What makes a building adaptable and how do we achieve this status of adaptability?

INTERVIEWER: So, there is no specific tool that targets adaptability...

INTERVIEWEE: Adaptability of the buildings, yes. It's a more of a practical approach, practical implication. Developers when they develop buildings, they develop them for a long time, say 20 years, they expect that the buildings will have tenants for twenty years, for the purpose that they designed. If after that period of time there is no tenant that would occupy the building, only then they will look at repurposing the buildings. That's when adaptability becomes important.

INTERVIEWER: But then at that time it's late because then how are they going to repurpose it? It means that they are going to have to demolish some of the structures, the walls. And what does that do to the environment?

INTERVIEWEE: Yes, exactly.

INTERVIEWER: how much do you think there is awareness around building adaptability in the industry, especially around green buildings? Are people, professionals aware of that concept?

INTERVIEWEE: I think in principle professionals are aware of the concept of adaptability. I think they appreciate also the importance of adaptability. But at the end of the day you have a tenant or you have a developer that you design for. And if the tenant or the developer are

concerned with these aspects, sometimes the effort is on different, say for instance on the experience of the occupant.
Occupants might want to have this great experience to be playful or whatever, whatever. So, the effort is more on the building creating an experience for the occupant, for the current occupant rather than making the building adaptable for any future use. But developers, I think, are in future at least, they can start looking at solutions that promote the adaptability of buildings as well. Because it's just the way the world is moving as well. We want to have less construction where possible. We want to be able to repurpose and reuse the buildings. So that we can reduce in general the negative impact of the construction industry on the environment.
INTERVIEWER: In South Africa, do we have a lot of green buildings that are adaptable, that are constructed to be adaptable?
INTERVIEWEE: Yes, look, in principle you can adapt any building, as I said earlier, whether it's green or whether it's not green, you will be able to adapt it. **INTERVIEWER**: That are designed to be adaptable.
INTERVIEWEE: That are designed?
INTERVIEWER: Not adapted later on when there is a need.
INTERVIEWEE: Look, I can tell you that the interiors are designed more to be adaptable. The building as a whole, perhaps but the interiors of the green buildings are designed to be more adaptable, definitely.
INTERVIEWER: What can possibly be done to improve awareness of building adaptability so that more green buildings in the future will be designed and constructed to be adaptable? What can we do more to raise awareness around adaptability?
INTERVIEWEE: Well, for instance, adaptability maybe should become part of the curriculum of students? I had recently a workshop with the University of Pretoria on SICON. Where SICON is a psychology within the construction industry, and it was mentioned on a number of occasions that psychology was not considered important aspect in the construction industry. But this is wrong because there is so much human interaction, human work within the construction industry that the University of Pretoria has taken the initiative now to bring psychology or a psychology aspect into the curriculum of most students. Not as a full subject, obviously, but as part of a subject so that they can learn about human personalities, ways of negotiating, ways of behaving in the industry and so on and so on, which is very critical.
Perhaps that should be the approach with adaptability as well. The department of construction economics in all universities could develop content to teach students. They are already being taught on sustainable buildings. So, it's perhaps as part of this course that they start learning about adaptability as well. And I think the educational institutions are the first ones to start promoting buildings that can be easily adapted.
INTERVIEWER: Then in terms of accreditation, is there anything that can be done to ensure that it's also a tool? A tool is developed to measure it so that it can be?
INTERVIEWEE: I don't really know whether a tool must be really developed, but perhaps the Green Building Council can consider extending some of their schemes. Just to include in principle more requirements towards the adaptability of the building. For, instance, we're considering now all kinds of resilience in buildings because of changes in the climate environment in the last years. So, while we are looking at resilience, we could also be looking

at adaptability as well. How does a building adapt as the conditions, environmental conditions, change? So that's another way of doing it probably?

INTERVIEWER: Is there anything else that you want to add on top of what we have discussed?

INTERVIEWEE: It's a very interesting subject that you are going to write your dissertation on. And it would be good University of Cape Town must publish it in quite a number of construction journals or academic journals as well. So that people can read about it and become more conversant when it comes to adaptability as well.

Are you researching literature on the subject as well?

INTERVIEWER: Yes, I did, literature review.

INTERVIEWEE: You did the review?

INTERVIEWER: Ja.

INTERVIEWEE: You did the literature review, and what are you finding? I mean, did you do a literature review in what's happening in other countries in terms of adaptability?

INTERVIEWER: It was more of like Western countries, it's more prevalent there than here. I wanted to find out how is the situation in South Africa? How are we viewing adaptability vis-a-vie green buildings? Because I feel like these two concepts are abstract. We talk about sustainability and green buildings and we talk about adaptability. Can we bring these two together? That's where my topic came from.

INTERVIEWEE: Yes. Okay. Well, very interesting, once you're finished your dissertation please do share it.

INTERVIEWER: I'll do that.

INTERVIEWEE: So that I can share it with my colleagues here as well. I mean, by I think that...

INTERVIEWER: It will bring more awareness.

INTERVIEWEE: ...everybody will learn. Yes, no definitely. And what triggered your interest in adaptability really?

INTERVIEWER: The thing about it, I also wasn't aware of it. Then I was doing module skills for professional registration as a quantity surveyor. There are modules that you have to take. Then there was an article on building adaptability, it fascinated me because I'd never, I mean, in construction industry like never had anything like that.

So, I wondered in my mind like, if I don't know about this, who else doesn't know about this? I started to research about it and then submitted my proposal to my supervisor. And then my supervisor linked it to sustainability because adaptability speaks about sustainability a lot. So now already we have, we have something about sustainability that we are dealing with. Then let's try and bring these two together and see whether, can they work together, is there a link?

INTERVIEWEE: There is definitely a link. There is definitely. I mean, as I said sustainability intrinsically speaking should lead to adaptability as well. But the concept of adaptability has not been detailed properly yet within the sustainability tools that we're working with. So, there is room for improvement in that area, definitely. And perhaps your research might inform what the green building council can do with their tools as well? Maybe they will decide to add additional credits, additional requirements so that they can award...

CERTIFICATE OF VERACITY

We, hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

NAME OF AUDIO: INTERVIEWEE E

DATE COMPLETED : 27/08/2019

INTERVIEWER: Thank you for making time for this interview and availing yourself for the interview. My name is Siduduzile Ndiweni, in short you can call me Dudu. I'm a student at UCT. I'm studying towards a Master's in Property Studies and as part of my dissertation, I am doing research on green buildings and their adaptability, their ability to change with, to adjust to change in time. Okay, can you introduce yourself a little bit and tell us about your experience in the industry?

INTERVIEWEE: Okay, I studied architecture, under graduate degree in architecture from the University of Pretoria. Then immediately went on to study a bachelor of engineering in civil engineering and completed that in 2016. I started working at Aurecon in 2017 in the structural engineering department. So, I've got about two and a half years of experience as a structural engineer now.

INTERVIEWER: All right. So, in your line of work or even at school, have you encountered building adaptability? What is your extent of knowledge in building adaptability?

INTERVIEWEE: We haven't worked on any project so far that allows for adaptability of use in the future. But we've got a couple of projects where you design for the first phase, for instance, with the potential of future expansion. So, necessarily to design the structure for future expansion purposes. Meaning you need to design it for the future loads and things like that. In my studies I did, in architecture, come across future use adaptability. For instance, of office buildings that you would change perhaps later on to become a residential building. That you can change the inside of the floor plan to adjust it for a different use. But apart from that, not very much.

INTERVIEWER: Okay. So, you haven't worked on green buildings that were designed for adaptability? Have you worked on green buildings at all?

INTERVIEWEE: Not yet.

INTERVIEWER: Not yet.

INTERVIEWEE: No.

INTERVIEWER: Okay. Are there any projects that you have worked on that are not necessarily green buildings that incorporate adaptability in their designs? Have you designed for adaptability?

INTERVIEWEE: Maybe you should just explain what adaptability is your book so that I can make sure I understand it correctly.

INTERVIEWER: The way you explained it, the way the building is able to respond to change. The way you design a building in such a way that if the change of use happens later in life, it is able to adjust to it without demolishing the building or putting down a lot of holes.

INTERVIEWEE: Okay, so for instance, in structural engineering specifically, what we sometimes deal with, for instance, we're doing a refurbishment project at the moment at the university for the residences. So, the residence is being renovated and in doing renovations, then the interior of the building sometimes changes. For instance, the layout, which to a certain extent is adaptation. It's according to future needs you've got different rooms that suddenly are required, other ones aren't, etcetera. So, you're changing the layout of the internal structure of the building. By doing that, what we as structural engineers would do is check, for instance, floor slabs. If they've been designed for this type of loading. We then have to go and check the changed loading, is the existing structure going to be strong enough to account for the change. If you're doing major adaptation changes in a building, for

instance, going from residential to commercial, then there's a completely different set of loading codes that you need to account for. And so, in that situation if you've got all of the design documentation, you can then quite easily check if it is going to be able to adapt to the new use.

If it's not strong enough, then a structural engineer would propose, okay, we need to add extra strengthening to this building to allow the use of it to change. In terms of renovations, structural engineers give a lot of advice and do a lot of checks mostly. But in terms of the current projects, there haven't been major use changes. It's mostly just smaller internal refurbishments that we've been dealing with so far.

INTERVIEWER: All right. Are there any specific design elements that can be incorporated in the design to make the building or the design adaptable to future change?

INTERVIEWEE: Yes, so for instance, I'm actually thinking of, there's a project that one of our overseas offices have been working on, mostly. Where they've designed it for a certain use and post the event that it is being designed for, it needs to be converted into something completely different. I'm not entirely sure I'm allowed to tell you which project it is, so that's why I'm being very careful not to mention that, but we have...

INTERVIEWER: Is it still ongoing, that project?

INTERVIEWEE: Yes, so we do have some projects like that where, for instance you design with the ability to dismantle parts of it, for instance. If, for argument's sake, you've got a steel structure, steel because everything is connected together, is bolted together, for instance. You can assemble it on site and that means you can also disassemble it fairly easily. If you are looking at being very adaptable in the building sense, you have to consider the construction material itself. To allow for a fairly easy change in geometry of the building or design.

Whereas concrete is far more permanent, it's usually cast on site. So you usually have form work where the concrete is cast into and then it's there. To demolish concrete is very labour intensive. If you're going to go the concrete route then you have to look at precast concrete which also does get assembled on site, could also then be taken apart again. It's very much about the construction material that you actually use, which allows then for fairly flexible design.

Also, to a certain extent, if you design the main structure, that it's a shell for the building and the internal can then be adapted. That's also a different way of accounting for future adaptability.

INTERVIEWER: How does building adaptability relate to sustainability of buildings or even specifically of green buildings? Like, is there a relationship there, is there a link between adaptability and sustainability?

INTERVIEWEE: I think there definitely is, because we look for sustainability. A large part of it, as my understanding goes, is that your life cycle of your building is very important. If the developer knows, okay, he's got a client who's got a lease for the next 10 years, he has to consider what happens after those 10 years. Because the building still has lifespan in it and you need to be able to adapt for whoever might want to use the building 10 years down the line. The longer you can effectively use a building in its current state, the better for the life cycle analysis of the building, the better for your Green Star rating, for everything. Because you can actually say that if you can dismantle it at the end of its lifespan. Say, for argument's sake you know there's a pavilion that needs to be set up for an Olympic game. You need a

pavilion because you need to house people, you need to provide, I don't know, seating area or something. If you design it in such a way that you can dismantle and assemble it again somewhere else where it can be useful for the rest of its life, then that is a sustainable alternative. If you build something that is only valid for that one event and becomes obsolete afterwards, that's not sustainability. Sustainability is considering not just the materials and like how environmentally friendly a material is, it's also about the lifespan of the building itself.

INTERVIEWER: Okay. So, there is a connection between those two?

INTERVIEWEE: Definitely.

INTERVIEWER: Okay. You said you haven't worked on green buildings, so I'll stay away from green buildings. And then in terms of awareness of building adaptability, how much awareness is there out there, within the industry in terms of professionals and other stakeholders?

INTERVIEWEE: I think in terms of structural engineering, it very much depends on the architect who's on the project. If the architect and the client push for something like adaptability and sustainability, then it falls to the engineer to make it work. But in general - I think of the studies that we did, for instance, we learned far more in architecture regarding adaptability, sustainability, green building designs. You don't learn about that in civil engineering.

In terms of engineering, of the engineering industry, if you're looking at structural engineering specifically, there's very little consideration to the full lifespan of the building or whether the design decision will allow for future adaptability unless the client pushes for it or the architect pushes for it. So, ja.

INTERVIEWER: So, would you say there is awareness, it's limited?

INTERVIEWEE: It's limited awareness.

INTERVIEWER: Okay.

INTERVIEWEE: I think it's very much project driven. So, if you've never worked on a project where the architect and the clients say, 'we're going to design for adaptability', then it's very unlikely that anybody would have an in-depth awareness of it.

INTERVIEWER: Okay. What can be possibly done to make sure that there is more awareness around building adaptability and also how it can also, how that can assist in green buildings? How can you raise awareness of building adaptability?

INTERVIEWEE: I don't know. I think, in general, there's a bit of bias and prejudice against green building because it brings in a whole list of limitations that you are and aren't allowed to use certain materials, et cetera, et cetera, to get the rating. From an engineer's point of view, there are very few engineers who actually say, yes, let's do this as a Green Star building, let's do this as an adaptable building. Because it brings in a lot of complexities.

It's very straight forward to design something in concrete. It's a lot harder to design it with the intent to dismantle it or with the intent to allow changes to this building in future. Because the building as a whole works a certain way. And if you start removing parts of it, the building, the whole building system changes. So, from a structural engineering point of view…

INTERVIEWER: You don't want to go there.

INTERVIEWEE: A lot of the engineers don't want to go there. But I think, in terms of raising awareness, if you have more presentations at varsity, for instance, you start bringing it in at under graduate level. And teaching people about adaptability and how in this very swiftly changing world, you can actually make your buildings into responsive, kind of, smart buildings that actually can account for future changes.

Because the way work is changing. The way we design buildings is changing. I mean, 20 years ago, everything was on 2-dimensional CAD drawings. These days you model the entire building with all of the surfaces and everything into a 3-dimensional model. You can do a walk through with the building with a visual reality headset. You can do like a whole bunch of stuff that you could, you couldn't do it 20 years ago. It allows you to visualise what could be.

So, with the dawn of all of this new technology, there is a certain amount of capability to look at option A, option B. You can see the building as it is now and what it might be adapted to be one day. We have that capability a lot more now, which is fantastic. But raising awareness about it, again, falls back to project related, so what can be show-cased in a project. If there is an award-winning project that is based on the principle of adaptability, immediately it raises awareness in the entire industry. Because you start seeing people saying, oh, you know, that's cool, let's see if we can incorporate it into one of our projects.

I think it feeds off each other. Awareness needs to be created by actually implementing something. And also, by then teaching students about it who then take it into the workspace, because students, you've got a captive audience. You've got people who are sitting there in class because they have to sit there. So, teaching them about it as you go through the structural design classes, et cetera, that is a way to raise awareness. I don't know what else to suggest.

INTERVIEWER: Okay. I think you have answered all the questions. Is there anything else that you'd want to add to the topic?

INTERVIEWEE: No, I don't think so. I think I spoke enough.

INTERVIEWER: Okay. All right, thank you Kristel for your time and your effort to help me in my research.

INTERVIEWEE: It's a pleasure.

CERTIFICATE OF VERACITY

We, hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

NAME OF AUDIO: INTERVIEWEE F

DATE COMPLETED : 27/08/2019

INTERVIEWER: Thank you for giving me this opportunity to talk to you and have this conversation. My name is Siduduzile Ndiweni and in short you can call me Dudu. I'm a student at UCT. I'm studying a master's degree in property studies. As part of my thesis I'm doing research on green buildings and their adaptability to change of use. Would you mind to introduce yourself a little bit, just tell us who you are, and the work that you do around green buildings.

INTERVIEWEE: For sure. I run my own company called Masplon Green Building Consulting. I have been operating now for seven to eight years now and I work with the Green Building Council to green star to certify buildings around South Africa. I actually mainly work on existing buildings certification; however, I have worked on a couple of new builds. I have certified I think about fifty buildings...

INTERVIEWER: Five zero?

INTERVIEWEE: Yes, to date. And I'm currently working on thirty-five. So, in the next couple of months it will to be, ja, it's going to be a nice number of buildings that I would have certified. That is my introduction, I guess. I live in Johannesburg and I operate from here at the moment. I moved up from Cape Town where I was working before. My background is in property studies at UCT.

INTERVIEWER: Wow.

INTERVIEWEE: I see, I think your supervisor is Karen.

INTERVIEWER: You know her?

INTERVIEWEE: She was my supervisor as a well

INTERVIEWER: Wow, what a coincidence. Okay.

INTERVIEWEE: I actually did my thesis also in green buildings when I was at UCT. I think it was in the year 2009 so that's ten years ago. My subject was drivers and the adoption of green building principles and practices in private schools in South Africa, which was quite interesting. None of which I've actually have gone into business with but that has its own barriers which I did research in my thesis.

Yes, so the property studies then I did a few years in property management. And then certifying existing buildings is basically Green Property Management, which is where I am absolutely passionate about and fascinated by it. That is my intro.

INTERVIEWER: You have always been interested in green buildings?

INTERVIEWEE: Yes, I have, ja. Throughout the property studies degree, I always think about my projects around that.

INTERVIEWER: Okay.

INTERVIEWEE: That thing, yes.

INTERVIEWER: Wow, very interesting. In your line of work have you come across building adaptability? What's your understanding of building adaptability?

INTERVIEWEE: Building adaptability, I guess, in my understanding is —it's a difficult one. I guess it's taking a building either in its new build or a concept or either an existing building and adapting it to be more sustainable and to adapt to its new environment. So the new environment being water shortages and wanting to reduce energy consumption. We would be actually adapting how that building operates in terms of energy and water efficiency.

And also taking into account people's needs and demands these days. People wanting to work in a healthier environment, a better indoor environmental quality. Better working

spaces to allow them to be more productive. And yes, I guess it is adapting how the building operate so that they can also design and build to be sustainable and resource-efficient.
INTERVIEWER: Do you have a project that you have been involved in? Because you say that most of your projects are already existing buildings.
INTERVIEWEE: Yes, a lot of them are existing buildings. I've certified some buildings which are already a hundred years old. Which I've received world leadership six -star ratings. Some buildings that are only two years old and have been designed and received a green star rating. And I've only received a three-star existing building rating. The ones that are actually being designed and built to be a green building, are only operating on a 3-star level. That is really interesting.
I think it really comes down to how the building is operated and if it's designed to be a certain way, is it actually operating that way? Are we actually tuning the processes to be operating how they're designed to be? How we predicted it to be? Is the building running the correct amount of hours as per our modelling? Because sometimes t's different when the building actually operates. Different tenants come in to what we thought were going to be there. An interior layout is designed differently to how it was intended to, so therefore it is more or less energy or water. I think a building needs to adapt regardless of whether it's designed to be green and resource efficient. I think it needs to always be adapting and always be changing. Well, like how the building is operated almost needs to be, I am just thinking as I go. Changing and monitored on a constant basis.
So that we keep up with the tenant demands and needs and usage and everything like that. So, ja. The question was is there a certain building that I'm working on?
INTERVIEWER: Yes.
INTERVIEWEE: I can use a building that I've certified and that was part of Black River Park in Cape Town, which is well known by the Green Building Council. It was one of the first existing buildings to be certified In South Africa.
INTERVIEWER: It's called?
INTERVIEWEE: Huhm?
INTERVIEWER: The building is called?
INTERVIEWEE: The complex is Black River Park.
INTERVIEWER: Black Over Park.
INTERVIEWEE: Black River.
INTERVIEWER: Yes, okay, Black River Park?
INTERVIEWEE: Yes, It's in Observatory. There are seven buildings inside there.
INTERVIEWER: So, you've worked on this green building?
INTERVIEWEE: Yes, there is plenty of information on the web about it. So, you can go type in and type green building and there'll will be a lot that come up. Ja, that is the project that I would refer to in the questions, ja.
INTERVIEWER: Was it already assisting, was it a new construction?
INTERVIEWEE: Yes, it was an existing building.
INTERVIEWER: Have you ever worked on a building where the functionality of the building is changed? Let say it was a residential it becomes an office or vice versa. Where the use of the building had to change and adapt?
INTERVIEWEE: If I worked on a building where the use has changed?

INTERVIEWER: Yes, the use has changed and now it's got a different use but now you have to certify it as green.

INTERVIEWEE: No, not really. I mean, buildings, buildings change. There is a building that I'm certifying at the moment which was designed to be an office but has changed into an educational building. But because it's actually AMR Office Park in Bedfordview.

There are three buildings in the office park and two are now used as educational. So, it is like a tertiary education college and then third building can still be used as an office. The building has adapted to a different use. Being rated in terms of green I don't think really, I'm not sure what the question means there? Yes, the building use can change but how that impacts going green I'm not sure what, it's, ja. Maybe you can repeat the question? I'm not sure what you are really asking there?

INTERVIEWER: What I'm saying is have you accredited a building that had a change of use? Like it was designed to be something else but then later on because of maybe the change in the demand or the building uses requires something different.

INTERVIEWEE: Yes, I understand the changing use, yes.

INTERVIEWER: Have you had to assess and accredit a building like that?

INTERVIEWEE: No, not really, no.

INTERVIEWER: And then in terms of the design of the buildings, does the design of the building also get to be assessed when you are accrediting green buildings? Do you also assess the design?

INTERVIEWEE: With an existing building, yes you do assess certain design elements. But you don't get penalised for the structure of the building. If you have like small windows versus big windows, for instance, they don't expect you to change that or the façade of the building. But you get rewarded for what you do with those windows. So, if you put blinds up to soft glare coming in onto your computer screens. And to reduce solar going into the building. Yes, we look at design but it's looked at differently in terms of an existing building. For a new building, yes, you keep green in mind with the entire design process with the team and you'll design a resource efficient building that uses the least amount of energy and water possible. That will be the most comfortable building for that purpose, I guess.

INTERVIEWER: so, the Black River Park project, was the design evaluated when you were assessing it? Was it a part of your assessment - the design of that building structure?

INTERVIEWEE: Yes, like I said certain elements were assessed. But when we did that rating it was more on building operations and how you manage the building and how you monitor it. And on the actual energy and water usage, and predicted energy and water usage.

INTERVIEWER: Building adaptability is a design concept or design principle that is usually, not even usually, always it's embedded on the design. The architects or the designers, they allow for some building components to change and respond to change of use later on, during its life time.

So, would building adaptability be included in the assessment of the design? Is it something that will be looked at, to say, is this design adaptable to change of use? Is it something that you look at when you are doing the assessment of green buildings?

INTERVIEWEE: Yes, I think, now that you say that I'm wondering whether, maybe you should give me your understanding of building adaptability. Because I'm under the impression that building adaptability is a building being adapted in its design to be green.

Are you referring to building adaptability as a component of green design? So, once it's built, can it be changed later?
INTERVIEWER: Yes.
INTERVIEWEE: So, for instance to design for just disassembly would be a term, building adaptability.
INTERVIEWER: Yes. So, if an architect or an engineer has allowed for that in his design, is this something that you look at and something at any earn points. **INTERVIEWEE**: Yes. Okay, okay, so now I, so that's sort of a different understanding. There is a credit that we look at in the rating towards design for disassembly. Which means that if you build a building with whatever you build it with. But if you choose to either break it down completely and change the structure or change the way it looks, you can actually, it's designed for disassembly. Certain things can be screwed in and screwed out and not have to be bashed through and broken.
It's like building Lego, you can actually take it apart and change certain elements. Maybe it's the interior design of the office space or its floor can be changed into a parking lot or a parking lot can be changed into an office floor. Depending on, but yes, that would be considered a green principle because you would be re-using materials.
You would be, obviously, which is great, so you would be diverting materials from landfill, you wouldn't be creating waste and you're not demolishing. So, yes, that would be a green thing to definitely, for architects to incorporate into their design of a building, absolutely. It's expensive, it's very expensive to do and it's quite difficult to do to but people and buildings do it, yes.
INTERVIEWER: And then that elements will earn some points on your accreditation?
Yes, you would, yes.
INTERVIEWER: Okay, awesome. So, the Black, because we are focusing on this project, the Black River, ja, was that part of the assessment?
INTERVIEWEE: No, because it's not part of the existing building assessment. So it's only part of the new building assessment. Ja, let me think, no not really.
INTERVIEWER: It wasn't assessed?
INTERVIEWEE: No, I mean certain aspects of it will be assessed and different credit, so like, maybe in your waste managements. Where you reuse, where you create like a depot where you can re-use certain office components. For instance, ja, so like building re-use, like the materials can be re-used, like movable items or desks and chairs and maybe this office is not using it. Then your actual building can create some sort of thing with the tenants where they can sort of buy things. But not really, you know. **INTERVIEWER**: Would you say that there is, is there a specific rating to that targets building adaptability in South Africa, that focusses on building adaptability and awards...?
INTERVIEWEE: No, not really.
INTERVIEWER: ...efforts around that?
INTERVIEWEE: No. But I think, I think just before we carry on, can you give me your understanding of building adaptability? Because I'm worrying that I'm not answering these questions properly. What is building adaptability, can you tell me?
INTERVIEWER: Building adaptability is, like I've said it's a design principle that allows the building to be able to adapt to change of use.
INTERVIEWEE: To adapt to change of use? Okay.

INTERVIEWER: For instance, you have a, like what is happening in Joburg. You've got a residential apartment, and then because of change of demand or because of any other reason you want to convert it to an office or a student accommodation. Is the structure able to allow for that or you will have to demolish some of the walls or demolish the whole structure to build a new apartment? So, if the building is designed to be adaptive, if it's designed to be adaptable, there are design elements that are allowed in the design, so that if the functionality of the building changes, it's able to accommodate it. The demolition is still there, but it's minimal without a lot of demolishing. Where the demolishing...

INTERVIEWEE: Yes, I can say how is, how much is… yes, okay. Ja, all right.

INTERVIEWER: So, the question is, is there anything specifically targets that, that looks at the design of the building and say, this is adaptable and using this tool we can reward those efforts on the accreditation.

INTERVIEWEE: So not a rating tool in itself, no. I mean, there might be but none that I know of, but yes it is a component within the green star rating.

INTERVIEWER: It is accommodated somewhere but there isn't really specific.

INTERVIEWEE: Yes, no, no, it is. Say for instance there are a hundred credits in the rating tool, then maybe theirs three credits for building adaptability or design for disassembly, which is I think...

INTERVIEWER: It's a component of building adaptability.

INTERVIEWEE: ...the same thing, yes. But, no, not a credit as such. But I think it will be good for you to become familiar with the rating tool and the credits within the rating tools, especially in that in South Africa, as part of your research.

INTERVIEWER: That's why I am talking to you guys, because I'm thinking you guys you can assist me. Because I've done my literal review and, of course, I've got my ideas. But I want to find out what the situation is in South Africa. Would you say the current environment assessment tools that we have in South Africa to rate green buildings, are they adequate to also measure building adaptability?

INTERVIEWEE: Yes, they can, I mean adaptability can be included in a rating tool. It doesn't at the moment so, I mean apart from that one credit that I can think of. But, ja.

INTERVIEWER: Okay. Is there a link between building adaptability and sustainability, especially of green buildings? Is there a connection that you see?

INTERVIEWEE: Yes, I think so, definitely. Ja, absolutely. Because if you're using less materials and you wouldn't be demolishing as much and therefore it's lighter on the earth and lighter on the carbon footprint of that building change or that building adapt. For instance, like you said it's a residential building had to turn into an office building, an office building had to turn into a parking garage. Or an industrial building had to turn into an office. If it could just be, maybe reconfigured in size without the actual structure changing. Yes, absolutely. I think there's definitely, there's definitely that link between sustainability and building adaptability, ja.

INTERVIEWER: So, if building adaptability were to be embraced like every green building is constructed to be adaptable, do you think that it can in some way enhance the sustainability of green buildings in the long run?

INTERVIEWEE: Yes absolutely. Just buildings in the long run, whether it's green or not. I think, because a green building encompasses so many different elements. But especially in a

new build it can often be perceived as quite expensive upfront. I think, ja, just for buildings in general, I'm also for green buildings, definitely. Although the only barrier I would think of is cost.

INTERVIEWER: Okay, in what way?

INTERVIEWEE: I think it would be expensive to make a building, build a building for basically two different uses or three different uses. It would be in professional fees and in material and a bunch of things. So, I think there would be quite a significant cost in build or additional premium on build, ja.

INTERVIEWER: But it will enhance sustainability?

INTERVIEWEE: I think so, yes, in my opinion.

INTERVIEWER: How much awareness is there around building adaptability in the industry? Like, do a lot of people know, are they aware about this concept, in your opinion?

INTERVIEWEE: It's not that topical at the moment. I think because, I think people are focussing on like the low hanging fruit and the things that are quite obvious. So, like your energy reduction and your water reduction. Because that's a direct impact on your bottom line. I think to get a building "green", like there're a few things that you can focus which are quite a challenge as it is.

You know, there are still plenty of buildings being built that aren't green. So, it involves a few smarter ways to build and to operate naturally. Like you would want a building to be as resource efficient and operate as efficient as possible. I think what developers and clients are focussing on is, are like the basics at the moment. With the exceptions of a couple of buildings going for that all out green building status certification. So, no, I don't think yet, I don't think there is...

INTERVIEWER: A lot of awareness.

INTERVIEWEE: ...that much awareness about that because we're still trying to get the basics right. You know, so I think maybe in the coming years once people are developing with the basics as a no-brainer, as default, then we can move up to the next level of like smarter thinking and more advanced ways. I'd almost say that building adaptability is excellent, but it's a more advanced step, you know what I mean.

In South Africa we're are slowly getting there. Worldwide I know it's part of, it's part of what buildings are doing. Like you see, like there's residential homes made out of the pipes. So that they can be move around unchanged according to areas or bigger or smaller, things like that. So, there's tons of, I remember at the conference there were few talks about that. But here I think we're a little bit far behind. Hopefully it will be something that comes up in the future.

INTERVIEWER: So, most of the time when we say a building is five star-rated or four star, whatever it is, we, is there any reference, is building adaptability also included there on the rating?

INTERVIEWEE: It might be and it might not be. A building gets certified and it gets its star rating or its number of points based on which credits they are targeting in the rating. So say there is a hundred, so they might target one to fifty and not fifty to a hundred. But some might target twenty to, you know, so there are different credits.

So, you can't say a six star has targeted that credit and is adaptable. But maybe a lower rating has decided that that's what they want to do and they'd rather focus on that but then didn't

focus on other things. So, in general, no, you can't just say. But usually it's a six-star rated building will have the highest chance of having incorporated building adaptability.
INTERVIEWER: Is that the highest star rating?
INTERVIEWEE: Six-star rating, yes.
INTERVIEWER: It's the highest, okay. So, would you say that Black River Park project was accredited to be adaptable? Was it, was adaptability included in the …?
INTERVIEWEE: No, it was an existing building.
INTERVIEWER: Okay, all right. So, what can be done in the industry, construction industry, property industry, in the build environment industry to raise awareness of building adaptability, so that in future all green buildings are designed and constructed to be adaptable?
INTERVIEWEE: I think probably case studies. Take a few pilot projects, try to get a few pilot projects to do it and see how, first of all how much it costs, because people are always interested to see how much it costs first before they do anything. Like what would, is it going to give them a return? So, do a bit of a case study and a bit of a project to see how it actually rolls out in South Africa and is it actually practical and possible. As much as it is a really good and sustainable idea, is it actually practically possible here in South Africa at this stage?
And is that one of the things that we should be focussing on more than others, if we can't do it all together. I think with most things, you know, pilot projects. and there just needs to be a start and then education and awareness around those projects. I think for residential, I think it's great, because it's maybe n a smaller scale a bit easier than commercial side of things. Ja, I think things like conferences and bringing in international studies and talks and speakers like we did have at the annual conference last year, where they did speak about that. I think that raises awareness. And hopefully it will start getting momentum a little bit in South Africa at the right time.
INTERVIEWER: Do you think that there is a, is there a need for our buildings, specifically green buildings to be adaptable? Is it something that we need, is it something that is important? Is it something that we can consider?
INTERVIEWEE: I think there's a need because we want to be more environmentally friendly and we want to be more sustainable in general. But I think in terms of South Africa, I'm not sure there is as much of a need as maybe in a denser country where the building, where there is actually no space for urban sprawl. So, I think Singapore or Bangkok or, you know, where all the buildings are high rise, in Dubai for instance.
INTERVIEWER: And there is no space to construct new ones…
INTERVIEWEE: There is actually no space to construct new ones. Where the buildings are already high rise because there's no space to go out. And where land is a restriction. I think there would be more of a need and a demand in those types of areas. For instance, in Joburg, I mean, there is a lot more space for urban sprawl.
So, what people tend to do is if they need a building that needs to be for a different use, they find a green field site and they build a new one in a location that works? Or they demolish an old one that needed to be demolished anyway and build it out on a brown field site. But, ja, so I think, I mean, maybe in Cape Town a little bit more, but then again it needs to be that supply and demand sort of equation. I think, maybe in SA it's not needed as much as in other countries and maybe that's the reason other countries have adopted the principle.

INTERVIEWER: You mean there is no demand for it.
INTERVIEWEE: Yes, yes. I mean, we're always going to run out of land but I think we need to figure out what the drivers would be to do it. And is the driver because we don't have space and we need to change the building or is it an environmental driver or is it a monetary driver? So, figure out what the drivers are and see where they apply.
At the moment I don't think people are, ja, I don't know. I think it's a future, it's more of a future thing for South Africa. But internationally I think buildings need to be changed for different uses. Like, there is a shortage of residential living space in certain countries. And therefore, and more people are working from home and have flexible working hours and environments where now, you know, a lot of companies, big companies are saying well 50% of their employees can work from home three days a week. So, there's not much need for office space any more, but there's more need for residential. Maybe that office space, half of the office space can change into residential, where there is no more space for residential. I think in it time, I think in time it's definitely going to be a demand for it, but here at the moment I think it's a little bit premature. I hope it helps…
INTERVIEWER: Yes, it does.
INTERVIEWEE: I think the first few questions were a little off the topic, so I actually didn't understand what…
INTERVIEWER: Building adaptability was.
INTERVIEWEE: But then talking through it, it actually makes a lot more sense.
INTERVIEWER: You've got a better understanding now.
INTERVIEWEE: Yes.
INTERVIEWER: Okay. But thank you for allowing me to talk to you on such a short notice. Your inputs are going to help me on my research.
INTERVIEWEE: I hope so.

CERTIFICATE OF VERACITY

We, hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

NAME OF AUDIO: INTERVIEWEE G

DATE COMPLETED : 26/08/2019

INTERVIEWER: Thank you for making time for this interview. I'm glad that you allowed me to talk to you about this subject. My name is Siduduzile Ndiweni, in short you can call me Dudu. I'm a student at UCT, I'm studying Property Studies at master's degree level and as part of my dissertation I'm doing a thesis on green buildings, but the focus of my research is on adaptability. On how their ability to adapt to change of use, green buildings. So, to set up the interview, would you mind to tell us a little bit about yourself and your involvement in green buildings? What kind of work that you've done around green buildings?
INTERVIEWEE: I have worked on a few projects in Joburg that has been green buildings. Most of them have only been proposals, but I completed a project, not with the firm that I'm at currently, at Boogertman & Partners which is a 4-star rated green building and the building complex is called The Marc, in Sandton.
INTERVIEWER: Okay, so the name of the building is called?
INTERVIEWEE: The Marc.
INTERVIEWER: M-A-R-K?
INTERVIEWEE: M-A-R-C.
INTERVIEWER: Okay. Complex?
INTERVIEWEE: Yes.
INTERVIEWER: Alright. I can go to the green building website I'll find it, the details of the project?
INTERVIEWEE: I don't know if it's under that name, they rebranded it at the end. So I'll find the link for you on the site and I'll send it to you.
INTERVIEWER: All right. So, what is your extent of understanding of the term building adaptability? Have you encountered it in your line of work?
INTERVIEWEE: What I understand with adaptability is mostly when you talk about change of use. So, for instance, an office gets converted to housing or housing gets converted to a hotel or a hotel gets converted to a hospital. Do I have it correct?
INTERVIEWER: Yes.
INTERVIEWEE: Points for me.
INTERVIEWER: Are there any projects that you have worked on that had incorporated building adaptability on their design? Meaning that the building was designed to be adaptable, later on during its lifetime.
INTERVIEWEE: Absolutely, I think a lot of the buildings that we do at concept phase in pictures, gets designed in a fashion to incorporate for adaptability because the market changes so rapidly in South Africa. And while they're busy building a building the market might even change in that span. So, they might want offices in the beginning and then it becomes residential. So, there has been projects that I've worked on that has incorporated that type of thinking. And then I've also done a lot of as-built conversions, where it used to be offices and now it is actually residential, but that was 100 years ago. So the buildings were built 100 years ago, so they weren't built with the intention of going green.
INTERVIEWER: Okay. So, the process of adapting them, was it easy…?
INTERVIEWEE: Definitely not.
INTERVIEWER: Definitely not.
INTERVIEWEE: No, because back in the day like, I don't know, I think the buildings were built a lot more rigidly. And the construction was very thorough, so it's hard to change the systems.

And also, in older buildings there wasn't the technology that we use today. So, things like data centres and data cables and especially green building technology, it wasn't incorporated so it was hard. Especially if people want to convert an existing building into a green building and change its use, you have like a perfect product for what you're researching.

INTERVIEWER: It involves a lot of work, demolitions.

INTERVIEWEE: A lot of demolitions. With a lot of the older buildings, as they went through changes of use, people didn't necessarily document how the building has changed. So, you start opening up a wall and you discover new pipes and new systems that's been incorporated as technology advanced. So, I think that's a lot of difficulty and that like makes the costs go up. So, the QS's original estimate might have been X, but then it ends up being Y because there's so many changes and a lot of, like creating adaptability.

INTERVIEWER: Yes, I perfectly understand that because I'm a QS by profession. I'm just branching into property but I'm a QS. So, I understand that language. Would you say that The Marc building complex that we are referencing to today, was it built to be adaptable? Was it designed to be adaptable as a green building?

INTERVIEWEE: I think adaptable to the extent of, so The Marc has got retail at the bottom, okay, so it's a parking structure with two floors of retail. Then it's got two office complexes on top of the retail. The office portions were designed to be flexible in terms of office usage, so multi tenanted, single tenant, multi tenants per floor, multi tenants across floors. So in terms of adaptability that was the full extent of it. And also, retail is infinitely adaptable because you have to be to cater for tenants. So, I think that was the extent of it. It didn't go extreme change in usage.

INTERVIEWER: Okay. What elements, building elements, did you incorporate on the design to make sure that it is adaptable?

INTERVIEWEE: So, I think a lot of the, it was mostly services. So, wet services were pre-planned with more water points, electrical was also pre-planned with more rises and ducts to service certain areas. Every single service, in fact, was planned for more branches, more capacity and longer runs throughout and multiple connection points. Then in terms of the building design, I think it was always quite sensitive in how the façade is planned so that people can split up and how the floor plan has been designed. So that when you have adaptability of use and you have multi tenants, that the fire stairs still work and the fire, it complies with fire regulation and facades are still like in reason in the modulation of the facades are correct.

INTERVIEWER: Okay. Would you say that building adaptability is a design principle? It should it be something that should be incorporated in green buildings to enhance their sustainability in the long run? Is it something that can help the sustainability of green buildings?

INTERVIEWEE: I think so, yes. I think buildings should be adaptable, in general which will expand their or extend their life on earth, if you can say it like that. I think a lot of buildings get broken down too quickly because there's a change in market. But if we can create adaptable buildings it can, through the cycle and how the environment changes around it, I mean, right now this is a perfect office use but in 15 years' time this might be prime for residential. Without like demolishing a whole building and all that wastage, you can just adapt a building. So, I do think it's important.

INTERVIEWER: Okay. Would you say that, how much would green buildings be an ingrained feature of, how much should building adaptability be an ingrained feature of green buildings? Like when you're designing for green buildings, should they always include adaptability in their design? Is it important?

INTERVIEWEE: So, I think the one thing as a QS that you will know is that green buildings come at quite a like initial premium. And a lot of developers won't look at, the initial premium is very high for them. If they also have to incorporate the adaptability of services, it's going to put the cost through the roof. I think most developer's yields are like, the time span in which they want a return on their investment is mostly 20 years and then they're okay with if that building does.

So, I think there needs to be a mentality shift from the building owners and the building constructors in terms of what does adaptability mean later on. Because I don't think, you'll have a hard time convincing a commercial developer that you must create an adaptable building. But from a green building, if you look at it from the other way, from like the Green Building Council, I'd say yes, totally make it part of it. Or an extent of it, like aspects of it.

INTERVIEWER: So, you are seeing barriers that might hinder the implementation of building adaptability in green buildings?

INTERVIEWEE: Yes.

INTERVIEWER: Okay. Are there any advantages that you can, that you have noticed, especially on this project of having a green building being adaptable? Any benefits of adaptability of green buildings?

INTERVIEWEE: Absolutely. I think, as I've mentioned before, it's a lot about the market and a lot about what, a development is never static and it goes through a lot of change and a lot of change in corporate and commercial environment. So, the more adaptable your building is the like more leasable your project is, which gives you a lot of flexibility and then can incorporate any sorts of tenants.

INTERVIEWER: Okay. Is there a link or a connection between building adaptability and green building or sustainability of green building? Is there a connection between these two concepts that bring, that can bring them together? Because I know that green buildings is a phenomenon that is fairly, people know about it, there's awareness around it but green building, adaptability is not so much known. I feel like these two concepts are abstract. Can we bring these two, can they work together, can they co-exist? Is there a connection, is there a link between building adaptability and green buildings so that they can co-exist and be used as a tool to increase the sustainability of green buildings?

INTERVIEWEE: I think so. It's a very conceptual question but I'll try and answer it to the best. So, I think green buildings whether, no, not whether we like it or not. I think it's become a reality in terms of the where corporate governance and corporate, all the CSIR projects and when new companies or companies in general look for corporate spaces to inhabit or put their offices, a green building is absolutely part of it.

I think if companies are prone to also develop and change a lot in their own structure, so they might require more space, less space, whatever. So, I think there's a marketing angle that you can put to that which will enhance the aspect of green building and also from the developer and the building occupants [inaudible 12:50].

INTERVIEWER: Okay. So, there is a...

INTERVIEWEE: It's a marketing feature.
INTERVIEWER: There is a link that you see?
INTERVIEWEE: Yes. Definitely.
INTERVIEWER: Okay. All right. The Marc building complex that we're talking about, is it, it was rated 4-star?
INTERVIEWEE: Uhm.
INTERVIEWER: Was building adaptability also evaluated and assessed towards the rating?
INTERVIEWEE: To be honest, I can't remember. It was a while ago. I can't remember. I don't think it was one of the points that we tried to target.
INTERVIEWER: Okay. Even the design, because you said it was designed to be adaptable, was the design evaluated for its building adaptability? Okay, first of all, was the design evaluated towards getting rated for its greenness? Was it, because I know you can rate the design, you can rate as a complete building? Was it design rated?
INTERVIEWEE: Yes, it was design rated.
INTERVIEWER: It was design rated?
INTERVIEWEE: Yes.
INTERVIEWER: And was building adaptability part of the assessment?
INTERVIEWEE: I'm absolutely sure it was, but I will, I'm not, I think it was. So, I don't know if you know a company called – we had green consultants on it who did all the points and the whatever. But I'm sure that would have formed part of their initial design evaluation.
INTERVIEWER: Okay. But building adaptability, is it something that would be assessed on the design of that building? Is it something that they look out for when they are evaluating the building?
INTERVIEWEE: I can't answer that.
INTERVIEWER: You wouldn't know. Okay. How much do you think that the current rating, environmental assessment rating tools that we have are adequate in measuring building adaptability of green buildings? Do you think they are adequate, are they able to measure the adaptability of buildings?
INTERVIEWEE: I think adaptability is quite like a abstract concept and green building is also a bit abstract, in my mind. I think developers and commercial builders have become very smart in that and they know which boxes to tick to get a 4-star or 5-star rating. And adaptability if you put that in and you say you need 4 extra pipes per floor or whatever, the criteria would be developers would easily be able to achieve that. But I think it can be enhanced a bit more if you look at the green star rating system. I think most of the international systems look a lot more at adaptability than the South African rating system.
INTERVIEWER: What could be the factors that drive building adaptability in the industry? That could make building adaptability appealing or attractive to developers, to architects, so that they incorporate it in their designs and construction?
INTERVIEWEE: I think creating an adaptable project is a lot of work and a lot of pre-planning and a lot of like, more inputs from other consultants, engineers, et cetera in getting everything planned. From a design point of view, I think if you work smart it's not a hard thing to accomplish. Factors that would make it attractive, I think it's what I mentioned earlier. It is attractive for a developer to be able to convert his building when his lease runs out on his

initial tenant, and he can change from ABSA bank to a crèche, just saying the most random things. But I think it is commercially a good principle to work from.

INTERVIEWER: Are there any other barriers that you can think of or that you are aware of from working in green buildings, besides their cost, that can hinder the implementation of building adaptability?

INTERVIEWEE: I think with most things in the build industry is everyone is at very limited fees and, or very shortened fees. And creating an adaptable building is a lot more work for everyone. So, I think if the fees get adapted with that for architects and engineers and everyone involved it would be good. But if it doesn't then it's going to be a barrier because then architects and engineers are just going to say, no, we're not doing it.

INTERVIEWER: It's not worth it.

INTERVIEWEE: Yes.

INTERVIEWER: Okay. Then in terms of awareness, how much awareness is there with professionals in the build environment on building adaptability? How much do professionals know about it so that they can also include it in what they do?

INTERVIEWEE: With most developers, professionals I've worked with it is always a part of how they plan things. And even if it's not massive, like building use change, maybe in terms of how the office complex or the mall or the retail can change when tenants change, I think that is always incorporated. So, I think there is awareness. It's, I think what you're asking like, specifically looking at is changing it to a different use and I don't think it's a step too far. I think there's already technology and thinking for that.

INTERVIEWER: Okay, so would you say there's a lot of awareness around the concept?

INTERVIEWEE: In my field, yes. But I can't really, in commercial architecture, yes.

INTERVIEWER: How did you get to know about building adaptability? Was it something you learned at school, you came across at work or how did you get to know about it?

INTERVIEWEE: I think working with a lot of developers and always ask for adaptable buildings in adaptable spaces and being able to chop buildings into bigger and smaller sizes and phasing and all of these things it became a commercial reality not necessarily school.

INTERVIEWER: What can be possibly be done to improve awareness in the industry, in the build environment industry around building adaptability? Especially concerning green buildings, what can we do to raise awareness?

INTERVIEWEE: Start with the developers. They want adaptability but they also still, and the QSs, are very cost sensitive. I think creating awareness in terms of how it will improve the developers' income streams and yields and things like that would be greatly beneficial. I think architects can make most things work at the end of the day, they just need to know what the brief is. But I think QSs and developers are the biggest barrier to entry in terms of adaptability.

INTERVIEWER: But how would we make sure that the developer knows about building adaptability so that he requests, he demands for it? Because if he doesn't know that there's this thing that can help him down the line, 10, 20 years down the line, he won't want to have it because he doesn't know it. So how do we make sure that everyone that is involved, professionals…

INTERVIEWEE: What you're trying to answer…

INTERVIEWER: Yes, but I need ideas from everyone. How do we raise that awareness so that everyone concerned in the construction of a building knows about this so that they can advocate for it?
INTERVIEWEE: I think the biggest place to start is maybe at the leasing agencies. And the, in making them aware about how it extends their possibilities to lease or sell or market certain buildings. I think that would be a good place to start. Then also, it's always good to get product reps involved as well in something like this, because they push the change and they push the materials.
You're always thinking and can create new technologies, and as you probably know, a lot of companies like Sancobain have quite a far a reach. I think something like adaptability will do good for them but also for the industry in preaching this. I think it's mostly a partnering with different suppliers and different manufacturers. Then also speaking to the people who actually lease or sell the properties.
INTERVIEWER: Okay. All right.
INTERVIEWEE: Does that make sense?
INTERVIEWER: It does. But then it leaves the question to say who is going to give, how do those people get to know about adaptability? It must start somewhere.
INTERVIEWEE: Do you want the Green Building Council to take responsibility for it?
INTERVIEWER: If they can.
INTERVIEWEE: I'm sure they can. It's not stretched too far. I think they can advocate for it and they already have partnerships with everyone in South Africa and all the big developers and the architects and their reach is incredible. So, as part of, like their CPD courses and courses that they present, they can just add in how to make a building adaptable.
INTERVIEWER: Okay. All right.
INTERVIEWEE: That was much easier.
INTERVIEWER: Say that again?
INTERVIEWEE: That was easier.
INTERVIEWER: Is it?
INTERVIEWEE: Yes.
INTERVIEWER: All right.
INTERVIEWEE: Maybe asking who should be responsible for it?
INTERVIEWER: Ultimately someone must be responsible. But who is that someone? That's where the chain is beginning.
INTERVIEWEE: Yes, I think Green Building Council can take responsibility for it.
INTERVIEWER: Alright. Are there any other questions, anything like other input that you'd want to add to the conversation over and above what we have discussed?
INTERVIEWEE: No, but if I think about something can I mail you?
INTERVIEWER: Yes, please do.
INTERVIEWEE: Okay, cool.
INTERVIEWER: All right
INTERVIEWEE: Thank you so much, Dudu.
INTERVIEWER: Thank you for this opportunity.
INTERVIEWEE: Are you studying full time?

INTERVIEWER: I was studying part time, on a part time basis but I'm almost close to the end. I'm done with the course work. I'm now focussing on this part, the dissertation.
INTERVIEWEE: So, someone is sponsoring your studies?
INTERVIEWER: No, it's a, I'm sponsoring myself.
INTERVIEWEE: You're a brave lady.
INTERVIEWER: Like I said, it must start somewhere. So, I'm starting my own chain reaction. All right, thank you.
INTERVIEWEE: It's such a pleasure.

CERTIFICATE OF VERACITY

We, hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

NAME OF AUDIO: INTERVIEWEE H

DATE COMPLETED : 27/08/2019

INTERVIEWER: All right, thank you for granting me this opportunity to talk to you on this visit. My name is Siduduzile Ndiweni in short you can call me Dudu; I know it's a long name. You can call me Dudu. I'm a student at UCT. I'm doing Property Studies at Master's level. And as part of my dissertation, I'm doing research on green buildings. My focus is trying to find out whether green buildings are designed and constructed to be adaptable to a change of use. Would mind to introduce yourself a little bit and tell us how you've been involved with green buildings so far.

INTERVIEWEE: Okay. Hi, Dudu, I am head of sustainability at the Paragon Group. I've been involved in various buildings. Some of them design phase, some of them construction phase, where we've submitted to the Green Building Council for a new build certification.

INTERVIEWER: Okay. What is your understanding of building adaptability? Have you encountered it in your line of work?

INTERVIEWEE: With building adaptability, as far as my understanding goes, there are various levels of building adaptability. You get a smaller scale which happens more often, which I have wrote down as adjustable and that's basically the internal configuration. The builders can also be a bit more versatile, so that means internal partitions being moved in and out. Also, then the building being refittable, which is the change of performance of the building. Convertible it's changing of the actual use of the building. Scalable then means you can have it grow over time, changing the size. And then moveable, it's something that we haven't really dealt with before, but it's physically changing the location of the building. In Paragon, we mostly look at, up to a certain phase, a certain scale, so we do take into account the adjustability of the building, the versatility of the building and we have done projects where we either re-fit or convert a building into a different use of a building.

INTERVIEWER: Okay. So, are there any specific projects that we can discuss, that we can talk about where you have actually designed for adaptability and the building was supposed to be green, the building is green?

INTERVIEWEE: So yes, we can, one of our latest projects is 144 Oxford.

INTERVIEWER: 144 Oxford.

INTERVIEWEE: It's located in Rosebank and it's a commercial building. The building is only submitted up to this stage for a design phase of the green star. Once it is completed it will be submitted for as-built as well. So, within the Green Building Council you get two submissions. You can decide which ones you want to do, whether you want to do one or both. During the design phase, before construction starts and during construction, you'll submit design phase. And that's basically your intent of the building. So, that is what are you aiming to have in the building. Then you do one where you basically review what you've done. You look at what actually was built and then you submit that for another green star rating. You don't have to do both, but obviously it doesn't help a lot if you only have the design one and you've never actually built it in that, such a way.

INTERVIEWER: Okay. So, on this one you submitted for the design?

INTERVIEWEE: Yes, because it's still in construction, it hasn't been completed yet.

INTERVIEWER: But your designs are complete enough for them to be assessed?

INTERVIEWEE: Yes. We design basically what we submit to the Green Building Council through a green building specialist, is up to your tender stage. The tender drawings you send out and then that's what people cost on. So that's basically your design intent.

INTERVIEWER: All right. Would you say that your design incorporated principles of adaptability? Is it adaptable?

INTERVIEWEE: With this project it was incorporated up to a certain phase. The smaller phases or the first phases, which has a minor change in the building, and the building is definitely adaptable. That means it's mostly tenant fit-out. One tenant can come in, they can say they want just open office spaces and they want seven desks there, so the building completely allows for that. The building is also versatile. What, how we design our buildings, all of our office buildings, is on an 8.4 grid. Basically, what that means, every 8.4 meters we have a column in both directions. What allows for is the different sizes of offices being constructed internally. Mostly with drywall or like with these partitions that you have here, clear partitions. And they're de-mountable, so you can easily take them out, they won't damage the building at all and then you can move them around.

You can either have private offices where you have a small one point two, one point four two, which is super small or you can have a larger boardroom, for example, like this. And they're all on a modular system. They're easy to change, they're easier to adapt. You aren't left with a tiny little corner that you can never use. That's the principle how we design all our office-plates. It's even, we even design in such a way that our parking in the basements can be changed orientation-wise.

INTERVIEWER: Wow, how do you do that?

INTERVIEWEE: So, with the 8.4 x 8.4 grid, I can show you on the drawings, so I won't be able to. So basically, because you have a certain direction, so either you have your parking slotting in, they stick out slightly, like that. And then you have your driveway here. But when you come around a corner, you can also turn them like that. They just, because it's modular, you can fit in the same amount of parking in any direction. I mean in two directions. And it doesn't matter if you want to change them later for different types of circulation.

That doesn't restrict you to using the building in a certain way. And it doesn't mean that you will lose parking once you start using it in a different way in the future. The same goes for the office above. For the building you get different types of tenants. It doesn't mean that it was designed for, for example, Workshop 17 and We Work, they're a new type of office buildings. What they do, they have shared office space. Its small companies coming in and they can configure it however they need.

Or, for example, you have a large company and they take up the entire office plate. But what this design allows for is that either size of company can come in and they can use the space like they need to. So that's the one thing. The other thing that is also introduced in, or those are two things. The other thing that's also introduced is de-mountable partitions or de-mountable…

INTERVIEWER: On this project?

INTERVIEWEE: On this project, yes. So, the façade is designed in such a way for if in the future you decide that you're not using that building anymore, you can take off the façade and you can technically use it somewhere else. Because they're also designed in a modular pattern.

INTERVIEWER: By façade, you mean the external walls?

INTERVIEWEE: Yes, the external walls. It's not something that we introduce in all projects because you can't always introduce your modular pattern. But with this all the panels slot

into a certain system. And you don't have a lot of custom panels. That means, if a building is designed differently in the future, a completely different one, and you're not using this building anymore, you can take the panels and you can put it on a different building.

INTERVIEWER: The panels are made up of what? It's not brick and mortar?

INTERVIEWEE: No, these are glazing panels. That's one of the things that also counts for your green star rating. They don't really make specific mention of adaptability of buildings in the green star manual. But what they do mention is basically demounting wall facades and partitions.

INTERVIEWER: I think you're answering questions that I had. But what I'm getting from you is that there's no specific terminology that says building adaptability on the tools.

INTERVIEWEE: No.

INTERVIEWER: But then there is some criteria that kind of measures it.

INTERVIEWEE: Yes. They don't specifically, as far as my knowledge goes, they don't specifically say your building needs to be able to change from an office building to a residential building. That's not something they give points to. But you do get points, they do take into consideration. For example, if you are to change the building, what happens to those materials? And if you're introducing a new building, where did you get them from?

If you go to a site and there's a small building on that, you have to say what are you doing with that small building. You can either say, I'm using it as it is and I'm just adding this to it. You can say, I'm changing this and this of it, so I'm taking out all the facades but I'm leaving the columns of the existing building. Or you can say, I'm completely knocking it down but I'm using, for example, the bricks for this thing, I'm using the columns for this thing, I'm using that for that. You have to say what are you actually doing with the building. You can't just say, you can't just throw it away.

INTERVIEWER: Okay, because then you're wasting and you're affecting the environment.

INTERVIEWEE: Yes, because making new materials is very energy intensive. It takes a lot less energy to knock something down and re-use the materials than to say, no, I want new bricks.

INTERVIEWER: Okay. If green buildings are about designing buildings today for a more sustainable future, to what extent would you agree that adaptability should be an ingrained feature of green buildings?

INTERVIEWEE: This also depends on the scale of the adaptability. I think you have to look at the life span of a building. And then you also have to look at the cost of designing it for all the different options. So that has to be in balance. In my opinion, you should always allow for different tenants to come in. And up to a certain, you can allow for different uses, but I don't think it's very responsible to always say what if the building in 50 years we want to turn it into a residential building.

Because then you compromise what this building is now and you compromise how it functions now for a what if in the future. You have to put that in balance. Obviously, you design the systems in buildings to the best of the functioning. You allow for tenants to come in easily and plug into that system very easily without any major alterations. You allow for different types of people to come in the building without major alterations.

But saying that the building now is going to be this type and should it be something else in the future, let's just add like 500, like just make the floor plates so much bigger. Because then

you're not using your materials and your energies efficiently now. I think that has to be in balance.

INTERVIEWER: Okay. So, you're saying that if you want to make the building adaptable for a far future, you might end up over designing?

INTERVIEWEE: Yes. You have to be careful for that. And it depends on, you design up to a state of adaptability. You don't necessarily design up to a, you know, completely changing the use of the building. But we are looking at lots of buildings that have mixed use. Then you allow for a certain component which can be used as retail, a certain one that can be used as residential, a certain one for offices and they can be interchangeable. But saying that, okay, no, maybe this building will become like a swimming pool in the future, then how do you design it now that it's also a very good office building. So, you have to have that.

INTERVIEWER: Some kind of balance.

INTERVIEWEE: Yes, you have to have a balance. Another thing that I've mentioned here, is one of the kind of types of adaptability is also scalability. And that's also something that has to be in balance. If you're working on a new large development with lots of different buildings, you definitely have to take scale into consideration. And when you are designing it, you would say, okay, in the future we might have this and this and this, so let's now put things into place that would make that easy.

But, for example, if you're doing a new building in a very densely populated area and you only have one small site, why would you allow for that small site to be, because in your small site you are building up to the boundaries. You are kind of taking up that whole space. Then you wouldn't allow for the building to grow even more, because it's already at its full extent. That's kind of the things that also has to be in balance. It depends on where the building is and how it will be, how can you grow it in the future if you need to.

INTERVIEWER: Okay. How about, because I understand that you can make the interiors adaptable without making the, without changing the…

INTERVIEWEE: Yes, definitely.

INTERVIEWER: Even in a place where it's dense, like you are saying...

INTERVIEWEE: Then you would always...

INTERVIEWER: Then you can make the interior more adaptable.

INTERVIEWEE: The interior, with our, the way we design the office buildings, it's always adaptable.

INTERVIEWER: It's always adaptable.

INTERVIEWEE: Always, always. With our new office buildings, it will always be adaptable. It depends on if we're doing a completely different type of building like a residential building. It's not allowing for the same type of adaptability as an office building. But the office ones, yes. And the way we design our buildings, it is …

INTERVIEWER: All right. What design elements do you normally incorporate on your design to make sure that the building is adaptable?

INTERVIEWEE: I think that's something we've covered earlier on as well. But what we do is having, say you have that grid and you have de-mountable partitions in the centre, we also allow for the services to, you can plug into them easily. For example, at this stage we don't have aircon on every, in all the office, like for every single partition because we're not putting

that in now. But if a tenant comes in and they want their own piece of aircon, then there's, easily you can just connect to a pipe or you can disconnect…

INTERVIEWER: So, there's a central location of those services?

INTERVIEWEE: Yes. Well in the large building we have four locations where you can plug in to.

INTERVIEWER: Okay. To what extent do you think there's a connection between building adaptability and green buildings and their sustainability? Is there a connection between those two?

INTERVIEWEE: I do think that there's a connection. I think that's something we also spoke about. It is up to; it has to be something that is in balance. You design your building so that it has the most, you're using the most sustainable resources. So, the way the building is made up, you design it as sustainably as possible. And then, in the future if it's adaptable, it's still a sustainable building. So yes, partitions and stuff, we do allow for people to use it differently so that they don't take out all of the other materials. You don't want them to demolish the whole thing, to be able to build a new thing.

INTERVIEWER: Are there any benefits that you have observed of building green buildings with adaptability?

INTERVIEWEE: I think there are lots of benefits. I think it minimises the amount of material that's wasted if you get a new tenant. I think it's a more responsible way of designing, firstly, sustainably, but also then for the people using the space. You want to make it easy for people to change their environment. You want them to put as little as possible in for them to change it around, otherwise people do start wasting things.

INTERVIEWER: Any barriers that you see that can impede the implementation of adaptability in green buildings, in buildings as a general?

INTERVIEWEE: I think it's all down to the scale of adaptability. If you're saying you want to allow the best possible thing for the building now, like we discussed before, you don't want to over-design it for the, what if it completely changes. I mean we have adapted buildings completely into an office. So, we've changed warehouses to showrooms. We've changed office buildings to residential. We've changed a motor showroom to office, so that is definitely possible and you can do it very sustainably.

But I think there should be a balance of what you do allow for in the future. Some are minor refurbs, that we definitely allow for. Major refurbs into a completely new building. That's not, our office buildings we don't usually say, okay no one day it will be a residency, so let's already put in all the bathrooms, you know. That's not something we allow for.

INTERVIEWER: Okay. Do you think that in South Africa a lot of green buildings are built to be adaptable?

INTERVIEWEE: I don't think lots of them are built to be completely adaptable. It depends on what your definition of adaptable is.

INTERVIEWER: Okay. The scale, how far you can take adaptability.

INTERVIEWEE: Yes, I think lots of the new office buildings are designed to be inter-changeable with tenants, not necessarily with use.

INTERVIEWER: Okay, with tenants, not with use. Which is, it's an element of adaptability.

INTERVIEWEE: Yes, so you can say your all, your office building, so that any type of person that needs an office building can go in there. But not necessarily saying a building and then a car showroom, like an office building and then the car showroom. I think that's a different…
INTERVIEWER: So, it's more change of tenants than change of use?
INTERVIEWEE: Yes.
INTERVIEWER: Okay. Do you think that all green buildings should be adaptable?
INTERVIEWEE: I think up to a level again. I think you have to design responsibly for the now, so that it can implement, be implemented in the future. Otherwise you over-design all your systems, so you use so many resources for something that might happen.
INTERVIEWER: And then in terms of assessment rating systems of green buildings, do you think that the current rating tools that we have in South Africa, are they adequate to measure building adaptability?
INTERVIEWEE: I don't think they really measure building adaptability. They measure the re-use of the materials quite well. But I don't think they measure adaptability very strongly.
INTERVIEWER: Okay, all right. And then this building, the name of the building, is it 144 Oxford?
INTERVIEWEE: Oxford, yes.
INTERVIEWER: Okay. Is it there on the Website?
INTERVIEWEE: It should be on the website; I will double-check if it's there.
INTERVIEWER: When it was assessed for its design, was adaptability something that they looked at, specifically?
INTERVIEWEE: So, one of the queries that we did target was the de-mountable façade. And that's something that actually came from the façade engineering side. But not further than that.
INTERVIEWER: Okay. And then, what could be the factors that can drive building adaptability to make sure that it's a, there's an appetite for it in the industry, its attractive, people want to have buildings that are adaptable?
INTERVIEWEE: I think the different types of tenants that we get nowadays is already driving the property market. Like I said in the beginning, different types of office us like Workshop 17 and, what's the other one? We Work, places like that. They are already driving the market where you have to have an office that can change like people need it to.
I think that's already happening, in terms of changing the use of the building. I think we are seeing lots of projects where old buildings are being changed into refurbished, into new buildings. But I don't know if we really have a market that's saying let's allow for these old buildings to be adaptable to a large scale for these various ways.
INTERVIEWER: Okay. And then in terms of awareness, how much awareness is there around building adaptability?
INTERVIEWEE: I don't think, I think in terms of the small scale, there's lots of awareness. Because you have to, the interior architects also design so if someone decides, okay, now I need to change it to a larger boardroom, that's definitely taken into consideration. I don't know how much awareness there is to allow for the change of use.
INTERVIEWER: Okay. And then in terms of professionals, your colleagues in the industry, developers, do you think they are aware of this concept? Because if they're not aware they're not going to advocate for it.

INTERVIEWEE: I think, to a certain extent they are aware but it is also something that they have to balance out with how much the building is costing now, how much you're putting into it now. I think, the general public, I don't think they are very aware of it, I don't think really anyway matters to them as much because it's not something that they'll interact with every day. But I think developers are very aware of how we can change current buildings into new buildings, but they're not necessarily designing for the new buildings to be changed in the future.

INTERVIEWER: Okay. And then how did you come into the knowledge of building adaptability? Was it, did you come across it at work, or you already had prior knowledge of it before you started working?

INTERVIEWEE: So more when you start working in the industry. You learn more about the client's needs and how that needs to be accommodated. Looking at existing buildings, because we are currently doing quite a few changes of building use in the office, but it's not necessarily our buildings, originally. It's an old building from a different architect, years ago, that we are now changing.

I think we are becoming more aware of what's the best way to change an existing building. And then also, the modular system that we in our office use, it's also becoming, that's something I've learned new in office and it, as you go through the buildings it becomes more evident how important it is that you allow for different types of tenants to be able to go into this building.

INTERVIEWER: Okay. And then what can we possibly do to raise awareness around building adaptability?

INTERVIEWEE: Well it depends on what you need out of it. The question is, is it relevant to the general public? Will they, do they need to know that this building can be adapted to this in the future? How will that benefit them now? I think that's a question we first have to ask before we say, okay, do we just advocate and, like how is it actually affecting the people that we advocate for.

INTERVIEWER: But more to the professionals, people that are in the position to make decisions and make choices. How do we make sure that everyone that everyone that is involved in the build environment is aware of building adaptability?

INTERVIEWEE: I think, to, in a more of the development side, you have to speak to the future cost of buildings and the future income that people can generate from this building. I think you have to show how it's more profitable by doing this than not doing this. I think that's basically, that's kind of, how you – what do I say? I think that's one of the major considerations when you are looking at developing property is, what am I putting in to get what out of it? You have to provide a financial case in saying, listen, if you put this more into it, in the future you will be able to get this out of it, like a large amount out of it. I think that's a way to speak to people developing these buildings.

INTERVIEWER: Okay. What I'm getting from you is that you see cost as a hindrance, as a barrier?

INTERVIEWEE: I think it is a barrier and I think also the responsible use of materials and resources also becomes something. Not necessarily a hindrance, but something that you have to balance out with adaptability. It's not only cost, it's all of the resources that you have to put in.

INTERVIEWER: Okay. So where should this awareness start? Because it has to start from somewhere. Who's going to be telling the responsible people about the cost and the benefits, what they can get in terms of return? It has to start somewhere. Where is the gospel going to begin?

INTERVIEWEE: I think it's a balance between the people designing it, so the architects, the people that need these buildings, so that's the tenants, and then also the developers, because they are, in the end, the people that make the biggest decisions.

INTERVIEWER: Is there a way of incentivising this so that it becomes a, something that is appealing, like giving an incentive?

INTERVIEWEE: I think, even with the green building rating system, it's often in the sense of a financial case, because it attracts people. You can say, my building is a green star rated building, people acknowledge that it's a green star rated building and you as a company, as a tenant, you like, okay, I also want to be seen as someone that cares about the environment. That could be incorporated in a type of even the green star rating system or in a different type of rating system saying, my company cares about this. So that also then drives the client or the developer to say, okay, so my tenants want this, so I need to provide for this.

INTERVIEWER: Okay, all right. Is there anything that you want to add over and above what we've discussed?

INTERVIEWEE: I don't have anything to add, but if you have any more questions, you're very welcome to contact me and I'll send it through via email.

INTERVIEWER: Thank you.

INTERVIEWEE: Okay.

INTERVIEWER: Thank you for this interview, you've been very helpful and gracious.

INTERVIEWEE: It's only a pleasure, we're happy to assist.

CERTIFICATE OF VERACITY

We, hereby certify that in as far as it is audible the aforegoing is a true and correct transcript of the recording provided by you in the matter:

NAME OF AUDIO: INTERVIEWEE I

DATE COMPLETED : 28/08/2019

INTERVIEWER: Thank you for making time for this interview. My name is Siduduzile Ndiweni, you can call me Dudu in short. I'm a student at UCT studying Property Studies at Masters level. I'm doing research on green buildings. But my focus is trying to, is at an angle of trying to find out how green buildings are designed and constructed to be adaptable to a different use or function. Would you mind to introduce yourself and tell us your work around green buildings so far?

INTERVIEWEE: I am a sustainability consultant at WSP and what we do we work with the accreditation of the buildings from the design stage until operations. We assist clients in terms of what sustainability principles to adhere to in order to ensure that their buildings are as clean as possible.

INTERVIEWER: In your line of work, have you encountered Building Adaptability, what is your extent of understanding of the term Building Adaptability?

INTERVIEWEE: In terms of the line of work that we're in, it's not a direct concept that we speak about directly as in Building Adaptability. But we do have functions within the green rating systems that look at it. In terms of my understanding, first my broad understanding of what the term is about, I think Building Adaptability is a concept that defines the ability of building structures to accommodate substantial change over time.

Obviously, over time, I'm meaning over the lifespan of the building for as long as the building is being functional, it's its ability to accommodate change. I think an adaptable building is one that has been designed to operate efficiently over time and for the service to be longer. I think in green buildings we term that as future proofing. So being able to future proof the building over time in terms of the changes that might occur over the lifespan of that building.

INTERVIEWER: Are there any projects, are there a project that we can reference to on this discussion that you have been involved in that has adaptability functions or performance?

INTERVIEWEE: There are a number of buildings which unfortunately I cannot coin the names of those buildings, but green rating systems has got different tools. We've got interiors and interiors particularly which looks at the fit out has a lot to do with the functionality and the flexibility of the space. It would look at the materials that are being used, whether they have been designed for dis-assembly.

Flexibility, in my understanding, it's coined to adaptability. So, when we're looking at materials that are being dis-assembled, it means that over time if you get a different tenant, you're able to just move and dis-assemble all the materials. When you're looking at partitions, what is the ability of the current tenant if they want to change the usability of the space to move the partitions around?

If you have seating functions, can we dis-assemble them and make sure that we recycle them and re-use them if we want to change the space into something different? So, the interiors too look at that a lot in terms of designing for dis-assembly and also making sure that you can reuse and recycle the materials over time. So, yes, a lot of our projects do look at that. Even some of our new designs, the ones that are going for a design rating, which particularly looks what you've got on paper and what the design entails.

Architects these days, I think, they've realised that times are changing a lot. And that clients right now over time they want to change the space and function of the space from just a typical office layout to something that will deliver to their clients as well. So they're trying to design for it to be multi-purpose and multi-functional. That also saves materials. Over time

it saves you cost, because then you don't have to, for lack of a better word, you don't have to kick down the wall...

INTERVIEWER: Demolish the...

INTERVIEWEE: Ja, demolish the wall and, because obviously that's too costly. So, materials are a huge thing in terms of adaptability. And also looking at the energy efficiency as well in terms of the load and the people that you're designing for. That also has a lot to do with adaptability when you're building your building. Have you ensured that, for instance, right now maybe your building is not designed, you're not looking having renewable resources at his point in time? But have you designed for a space where at a longer period, if a new tenant comes in and they want renewables on the roof, is there space for that? So, yes, we do design for those in mind.

INTERVIEWER: But isn't there a project that we can just use as an example for this conversation?

INTERVIEWEE: Unfortunately, not, we need clearance for that because it's a company policy where we need to speak to clients first and tell them that this is happening.

INTERVIEWER: Okay, involve them.

INTERVIEWEE: I can say, for instance, I can tell you where they are situated, but I cannot necessarily tell you the name of the project. So, we do have a couple of those in Sandton.

INTERVIEWER: Are they on the green building Website?

INTERVIEWEE: Yes. If you go on the green building Website...

INTERVIEWER: That's where I got your company name. I went there, there were some case study projects that are there on the Website. I just went there and look for those projects and the consultants, the professionals that were in there. That's how I got hold of your company.

INTERVIEWEE: We do have them, a lot of them. We do have them in Sandton, we do have them in Midrand. So, there are, we've got quite a few number of projects that have taken adaptability or flexibility into account.

INTERVIEWER: From what you've said I understand that there's assessment for the design and for the as-built.

INTERVIEWEE: Yes.

INTERVIEWER: Okay. So, on the design side, because building adaptability is a design principle, it's a design concept, something that is implemented on the design. When you're evaluate the designs, do you look at, do you have a specific look out for adaptability elements there? Is there something that you look out for? Is there something that is assessed on the design?

INTERVIEWEE: In terms of the green star rating, like I've mentioned earlier, it's not a direct — so, okay so, the green star manual is made up of categories. Within the categories you've got management, you've got indoor environmental equality, you've got ecology, transport and water. And within those categories you've got a number of credits that help us to assess the green building status of whatever structure that we're looking at.

And within those credits, for instance, we look at whether you've got an accredited professional, we look at building tuning, we look at the transportation.

But adaptability per se, it's not one of those credits or categories that we have within the green start rating system. What we do look at, like I've mentioned earlier, it's elements that

support adaptability but it's not directly rated and embedded as here's a credit that you need to assess this is adaptability, it's not there.

INTERVIEWER: From your working experience, how much are green buildings designed to be adaptable in South Africa? Are green buildings being designed and constructed to be adaptable?

INTERVIEWEE: I think traditionally, well, from my experience when I started out, traditionally many designers and I think owners, and many building owners and stuff, they preferred to work under the assumption that, you know, change wouldn't occur or affect their building structures. But I think over time with the uptake of green buildings and designing sustainability in mind, that has evolved, especially within the South African market.

Although it's not particularly something that has gained enough traction looking at where we're at, but I think it's growing. We're currently seeing more in it, I think, more designs in buildings that are being designed to be flexible in terms of the space planning. Then, that are allowing for convertibility for various needs of the tenants and buildings that are allow for expansion and accommodation of various needs over time.

So yes, it's there. It's not at a level where we wish it would be but it's there, it is gaining a little bit of traction over time. Because designers are beginning to realise that there's change and buildings go through significant change all the time. So, they need to design with that in mind. I think also, the idea of green buildings is sort of pushing that in terms of being able to future proof your building. And making sure that you not only designing for today, but even for tomorrow, whatever change comes through, your building must be able to accommodate all the changes.

INTERVIEWER: Would you say that all green buildings should be adaptable?

INTERVIEWEE: Yes. That's where it should be. Actually, when you come to look at it, green buildings and adaptability cannot be separated. If you're truly designing a green building, then it means that it should be adaptable. Because what we trying to do right now is trying to make sure that we are reducing the amount of raw materials that we're using. Obviously, adaptability looks at the reduction of using raw materials as well over time. Because right now, what are we trying to do. We're trying to eliminate climate change in terms of the effects of climate change. And if we are not designing buildings that are adaptable, then it means that we are working in reverse.

So clearly over time we're going to using more resources, we're going to keep consuming a lot of energy, our buildings are not going to run efficiently. We keep, we're going to have to keep demolishing because the needs of the people are changing and our buildings are not able to accommodate that. We're going to have to keep demolishing the structures building other ones and that's working in reverse. So green buildings should...

INTERVIEWER: Should be adaptable.

INTERVIEWEE: Should be adaptable, yes.

INTERVIEWER: So, building adaptability is something that can enhance sustainability of green buildings in the long run?

INTERVIEWEE: Yes.

INTERVIEWER: It's something that can really help sustainability of green buildings?

INTERVIEWEE: Yes, I think they are coined together. I think to separate the two will be doing an injustice to both of them. It's two things, in order to have a truly sustainable building. The

building must be able to function as efficiently and as responsible as possible over time. So, us talking about them as separate entities is doing an injustice just to the whole concept of green altogether.

I think also when looking within the South African context, because the green building industry is still growing. I think the green building concept is not that old, 11 or 12 years, but it's plus ten years. So, it's still gaining traction on its own. We are still growing, and I think also the language that we're using in terms of green is growing over time. So, right now these entities and these two concepts are going to be so coined that there's no way that you'll speak of the other without including the other. That's where we would like the industry to be.

INTERVIEWER: You have kind of answered the next question that I wanted to ask. Is there a link between building adaptability and green building, sustainability of green buildings?

INTERVIEWEE: Yes, we touched on it.

INTERVIEWER: You have answered it!

INTERVIEWER: I can see that you strongly believe that there's a link.

INTERVIEWEE: Yes.

INTERVIEWER: Awesome. But then in terms of our environment assessment tools that we are using as right now; do you think that they are an adequate measure adaptability of green buildings?

INTERVIEWEE: I think looking at where the market is currently and where we come from in terms of the sustainability generally within the South African context, although they are not as rigorous as they are supposed to be in terms of managing and encouraging building adaptability they are trying. But we need them to be more rigorous and more straightforward in terms of...

INTERVIEWER: More specific.

INTERVIEWEE: Yes. In terms of you need to design for adaptability and if you're not, then unfortunately we won't be able to rate your building green. It needs to be more specific. At this point in time, it's a bit indirect although it's there. We need that to come up with certain credits that directly look and assess at building adaptability.

And not only in design, because I mean we do have a lot of buildings are already...

INTERVIEWER: As-built.

INTERVIEWEE: Ja, that are already built, that are already existing, that are already functioning. We also need to ensure that they are also adaptable, so how do we do that? It should not only look at design, it should look at the entire lifespan of a building all together. Because within the green building rating tools we've got the new building which looks at the design in as-built.

We've got interiors which looks at the fit outs. Then we've got operations, existing building performance which looks at how the building is operated and how it's maintained. So, within all these tools, especially, because the biggest stock it's the existing building stock. You can see that right now not a lot of new construction is coming up. Most of the work is coming from existing building structures. So also, how do we make sure that they are adaptable over time?

They must also be assessed using that adaptability tool. And it doesn't necessarily have to be a standalone tool, it just has to be coined, nicely coined within the existing tools that we have.

INTERVIEWER: So, there's room for improvement in terms of …

INTERVIEWEE: There's always room for...
INTERVIEWER: ...the rating...
INTERVIEWEE: ...improvement. Yes, because obviously sustainability has evolved over time. And, I mean, green buildings, if they go back to green buildings only. Green buildings because sustainability is a broad concept. So, if we look at green buildings, that concept has changed over time. Our rating tools also have to evolve with that as it evolves. But I think, I'm quite confident and positive that's where we are going. Like I'm saying they are there in terms of space design and layout, space planning and the type of materials that we use. Those are the big functions that currently define adaptability within the tools. But there's more that can be done, there's more that can be encouraged.
INTERVIEWER: What barriers do you see that can stand in the way of building adaptability being implemented in green buildings? What can, what is there that can hinder the implementation of adaptability of green buildings?
INTERVIEWEE: I think, I'll start off this way. I think right now at this point in time the trend is moving in terms of designing for sustainability and designing for adaptability. The trend is moving and it's moving fast. It's almost like if you don't get on board, you are left behind and no one is going to come in and want to be in your building. Because right now we are building for people that know and understand sustainability and what they are looking for. So this day's, tenants, it's not only the developers that will say we want x, y, z.
Even the tenants that are going to be occupying that space will tell you that we want a space that's multi-functional, that's multi-purpose, that's flexible. This is what we need. If developers and designers don't get on board, they're almost going to be obsolete. So, it's not a choice. It's no longer whether I've got a choice or not. It's something that has to be done. In terms of something that may hinder that, it will just be, you know what, resistance to change.
If people refuse to want to change, which is more to do with perception than what people are used to. Because obviously people are used to a certain way of designing, and used to a certain way if doing things. And the moment you come in and introduce something else, there will be a push back. But I think at this point in time in terms of where we are, there's no time for pushbacks. Because we've got the technology to support adaptability. The technologies are there and they are no longer as, because initially when green building started, there was that whole debate and notion of everything is so expensive, it's pricey.
But right now, everything is at a competitive level because the technologies have been introduced worldwide. I mean, worldwide and allow us, prefabs are everywhere. Everything is everywhere and it's readily available. So one cannot say that we don't have x, y and z, we don't have the relevant materials so we cannot do this. We don't have the relevant systems and technologies. There's no way, everyone has to get on board, it's not a choice. The only thing is, that I see, is resistance to change.
That's the only thing and that has more to do with perception, like I said, in terms of how people perceive how things should be. And obviously if there's lack of awareness as well which is the second thing. If people don't know that things have to be designed this way and why they should be designed that way and function in that way, obviously there will be a problem.

You might design for adaptable spaces, and then the building occupants come through, they don't understand how to make use of the space, then it changes everything altogether. So awareness is a big thing in terms of what we trying to do as well. If there's not the right amount of awareness, then that can also be a hindrance terms of the progression of adaptable buildings. But I think it's possible.

INTERVIEWER: All right. Then in terms of drivers of building adaptability, what drivers are there that will make building adaptability appealing, attractive? More like that will cause an appetite in the industry for building adaptability? What is there than can drive building adaptability?

INTERVIEWEE: You know what, I think looking, currently looking at the projects that we've worked on and that we're currently working on, the biggest driver and factor of flexible spaces for us has been the rising consumer expectations. So the more people are aware of what they need, in terms of sustainability and design, and they're able to ask for it, then we're able to deliver it.

So, within this space, the sustainability space and green building space, that has been the biggest thing, the rising consumer expectations. I think, for, obviously that's on the consumer side. In terms of the, in terms of the — I'll tell you now. The developers, obviously they need incentives. That's all together in terms of green buildings and design. Like what is it, what's in it for me if I design an adaptable building?

What's in it for me, what's in it for me if design something that's flexible over time? Obviously, if people are incentivised over time in terms of what the government is doing. Legislation governs a lot of things, but incentivising people for going something that's good, that's very good and very good for the environment over time encourages the adoption of adaptable spaces. And another one, let me see. I think for me those are the two biggest ones.

INTERVIEWER: That stand out?

INTERVIEWEE: Yes.

INTERVIEWER: Okay. Do you think, would you say that there's a demand for adaptable green buildings?

INTERVIEWEE: Yes, there is because, the thing is like I said and it goes back to the rising consumer expectations and awareness. People right now are understanding that green buildings are saving them a lot in term of operating costs over time. So, they are demanding green buildings and multi-functional spaces. Where if they get in and they decided that today here we're going to have a separate office, office units. If we decide tomorrow that we want to have open plan everywhere, are we just able to take everything down? Dis-assemble it, pre-package it and donate it or put it in the store room and use it again over time? So, yes, there's, it's there.

INTERVIEWER: Especially in office market, office buildings.

INTERVIEWEE: Yes, especially in commercial office buildings, it's there. Obviously, because right now you've seen if there's a new building, you will see that there's this whole musical chair that's going on. The moment there's a new commercial office building that's built somewhere which is green, people are moving from traditional buildings to green buildings, because it offers them more in terms of operations.

Also, in terms of like just enjoying the aesthetics and the indoor air quality of the space. It's much more appealing to consumers these days as compared to traditional spaces. In terms

of the commercial space, it is musical chairs, people are moving along. And if they get into your building and it's not offering them that flexibility that they require, then they will move to the next one which offers them that flexibility which they are in need of. I keep on mentioning flexibility because for me... you can't separate the two.

INTERVIEWER: Yes, it goes hand in hand, yes, you can't separate the two. I notice that you've been speaking a lot about awareness. But how much awareness do you think is there in terms of professionals in the industry? People are that are in position to adopt the principles of adaptability in green buildings? How much are they aware of this, because if they are not, then they are not likely to advocate for it, or demand for it?

INTERVIEWEE: Yes, precisely. I think they are aware of it, but in some instances obviously you're also governed by what the developers requires because you delivering to a client. So, the client's needs always come first. But what I've seen happening now is that because the project team is aware of designing for flexibility or adaptability, they are able to encourage the client to relook their design and think of designing with flexibility and future proofing in mind.

So they are there and if the project team, for instance, if the architect and the designers are unable to advocate for that, and the interior designers, then when it comes to us as green building consultants if we're put into the project earlier on we are able to say, how about you look at this façade and this façade. Because this will help you over time.

For instance, because right now you're not only designing buildings for one tenant, it's always multi-functional. It's always different tenants. So, how are we ensuring that we're designing for those. Also, it's not like people design right now to stay in those structures forever. They move over time, and when you move are you able to get a different tenant. How do we make sure that that structure doesn't become obsolete?

Not only think of yourself now, but also think about the different type of audience that you designing for. So, yes, there is awareness. There could be more, but a lot of the people that are not designing for adaptability it's not that they don't know, it's because they don't want to.

INTERVIEWER: You think so?

INTERVIEWEE: It comes done to that, ja. They are aware it's just that it's something that takes them out of their comfort zone. If I'm used to designing structures that are very solid, that are boringly solid and, you know, there's nothing fun about them. It's almost if it's this way, whether you get in or not you cannot change anything. If they are used to that and that's what they've been doing all the time, you almost need to push harder for them to understand why this has to be done.

So, often it's not that people are not aware, they are aware. It's just that because it's something new, there is a bit of resistance in terms of, you know, getting on board. But it's like I said the market is changing because the rating tools are forcing everyone to get this concept somehow.

INTERVIEWER: But on a scale of one to ten, how much do you think the awareness levels are at of adaptable green buildings?

INTERVIEWEE: What's one, what's ten?

INTERVIEWER: On a scale of one to ten, how much awareness do you think is there?

INTERVIEWEE: But I think, is one like...?

INTERVIEWER: One is low, ten is the highest.
INTERVIEWEE: The lowest and the highest, okay. That's what I wanted to understand. I think within the South African context and within the project teams, obviously, the architects, interior designers, consultants, everyone on the project, I would say five and a half. It is there. It's there, it just requires more encouragement.
INTERVIEWER: Awesome. What can we possibly do to increase that awareness so that more green buildings are designed and constructed to be adaptable?
INTERVIEWEE: Obviously, it's giving the rating tools be more direct in terms of measuring that level of the design, in that level of the operations within existing buildings. If it's more direct and it's something we are looking for, we are saying okay, this is a credit that is looking at adaptability, is your building designed to do one, two, and three, one, two, three? Then obviously it will push the awareness.
And we need, I think like what you're doing right now in terms of publications also, because there's not a lot of South African contextualised content that looks at adaptability within the South African context. The publications are there, but they're not within our context. It's still a bit more Eurocentric and stuff. But we need something that works for us, something that speaks to our audience.
So, if I'm able to sit down and type in and get an article that's within the South African context, then I will encourage it as well. Also, we need professionals within the industry and the Green Building Council as the green accredited body accreditation body to advocate for it and speak about it more, you know, during the courses, during the conferences et cetera.
INTERVIEWER: Awesome. Are there any other things that you want us to talk about? Anything that you want to add on the conversation over and above?
INTERVIEWEE: Over and above what we spoke about? You know what, I think when we're looking at changes that occur over time or that are expected over time in terms of designing your building in a way that it's adaptable. Obviously, over time you'll have, the function of the space will change. Meaning that when we are designing, we should have that in mind. Designers should have that in mind when they're designing spaces. That over time the function will be very different. Right now, it might be a commercial office but someone might get in and want to turn it into retail. Is it able to easily convert or does it require more time, effort and money for it to be convertible. I think another thing is in terms of the, the number of, the influx of people that the space will be able to carry over time. What is it being designed for? With time if the current tenant, for instance, is saying I'm going to have fifteen occupants, just for example. Over time if another tenant comes in and they require to have 35 occupants sitting, is the space able to convert easily so that it can accommodate the influx of people that are coming through into the building? That's another thing that designers should have in mind and architects for in designing., I think.
And another thing, I mean, also looking at the energy loads, at the resource loads. Because another thing, I think you cannot only speak of adaptability without looking at the loads and like consumption of electricity, consumption of materials and resources. You must also have in mind in terms of what type of, the amount of loads that you're designing for. If, for instance, right now because you're having 15 occupants, it will require a thousand kilowatts per annum as an example.

If I have, if the maximum capacity for 35 and someone comes in and they want 35 people in that space, is the load going to be enough, in order to ensure that that space is still functional and operated and it's not operated in a way where the building is just like, I can't take this anymore. You must be able to design with that in mind as well.
Also just checking in terms of convertibility and how easy is that. Is it easy to convert it over time or is it not? Because if it is not, then it defeats the purpose. In terms of the materials that you chose, because obviously that dictates how flexible the space will be. And not only choosing materials that make it flexible but materials that are also green and sustainable. Making sure that they can be recycled or re-used. They can be diverted away from our waste stream and stuff. I think that those are the, some of the concepts that architects and designers should have in mind.
Also, just not putting structures and leaving them afterwards. There should be a level of awareness to the building occupants. That's something that we do with green buildings. Where we'll have a building users guide. That guide is issued to the building occupants. So that they know that this a green building, and if it's adaptable this is how it's meant to function. So that it stays that way over time.
Because now it defeats the purpose if you have designed it in a particular way and it's flexible and people come in, and they don't know...
INTERVIEWER: They can't use it.
INTERVIEWEE: And they don't know how to use it. Because we've seen a lot of spaces where things are convertible. Like, right, it will be a meeting room and then you can immediately switch everything and then it changes into an office. Then people get in but they don't know how to use that space so they complain. And the lighting can change, but it's because they don't have awareness. So, you must also make sure that afterwards, our building occupants get into the building, when they occupy it they are aware of the functionality of the space, and how it's meant to be operated. And the facilities team also, because they'll be the ones that are doing most of the work. So, it defeats the purpose if it's designed in that particular way. But the people that are occupying it over time, are not occupying it the way it supposed to be. So, it will lose those elements of adaptability and flexibility over time.
INTERVIEWER: It will become obsolete.
INTERVIEWEE: Yes, it will become obsolete because the people are not making use of it the way it's supposed to. By the time you get in a new tenant, everything would have to be changed. And you'll find that by that time the materials that are even there, they've just been worn down in a way that there's no way that you'll say I'm re-using this, or I'm doing x, y, z. So, the level of awareness to the people occupying the space is also a big thing, in order to keep is functional and growing over time.
And, ja, closing remarks is the industry is slowly but surely getting on that train. So, people are...
INTERVIEWER: There's hope.
INTERVIEWER: There's hope, yes. People are realising that these two terms are coined together, and obviously as a developer you don't want to be demolishing all the time, because that cost you a lot of money. So, in order for you to accommodate for different needs, what type of building do you need to be constructing in the first place? Something that will be easily convertible and adaptable.

INTERVIEWER: Interesting. So, you get to do all those things in your line of work as a sustainability consultant? To get involved in all those dialogues and conversations with the designers and consultants, engineers that are involved in their projects? Do you get involved in such meeting so that you can also advocate for such things?

INTERVIEWEE: It depends on the different types of projects that we're working on. And at what stage are we called into the project. Because sometimes when you are called in at a later stage, really there is not much that you can influence, the design has been agreed upon. Construction is going on, so it's almost like, you just have to get on board and only advocate for things that you can advocate for at that point in time.

But if it's earlier on in the design discussions, then you're able to influence the decisions that take place. As much as we are, obviously, we work within the core principles of the Green Building Council. And in terms of their tools, so meaning we have to adhere to the principles. But as sustainability consultants also, we are able to encourage our clients to think beyond just the now.

And also, if it doesn't mean that if it's not within the two, it's something that you shouldn't do. If it's sustainable, because there is a credit called Innovation, so it awards projects that go beyond what is required within the technical tools. So, we are able to say, how about you can get 1, 2, 3. How about your design you should get one, two or three. How about design with this in mind. Seeing that right now the projections are looking this way. So, yes. Sometimes we're lucky, sometimes not so lucky.

INTERVIEWER: Thank you, your insight has been very good. I enjoyed the conversation. I enjoyed the interview. Thank you so much.

INTERVIEWEE: I hope I was able to assist.

INTERVIEWER: You did a whole lot. Thank you so much.